UNIVERSITY OF KERALA

B.Sc. DEGREE PROGRAMME IN CHEMISTRY

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

SCHEME AND SYLLABI

2017 ADMISSION ONWARDS

Core Courses, Foundation Course II, Open and ElectiveCourses

Aim and Objective of the Syllabi

Aim

The B.Sc. Degree Programme in Chemistry covers three academic years consisting of six semesters and aims to provide the students with an in-depth understanding of and training in chemical sciences. The syllabus has been designed to stimulate the interest of the students in chemistry and prepared in order to equip the students with a potential to contribute to the academic and industrial requirements of the society. The new, updated syllabus is based on an interdisciplinary approach and is infused with a new vigour and more depth. Chemistry being an experimental science, due importance is given to the development of laboratory and instrumentation skills.

Objective

The main objective is to provide to the students an in-depth understanding of the basic concepts of chemical sciences and enable them with tools needed for the practice of chemistry, which remains a discipline with much stress on experimentation. It attempts to provide a detailed knowledge of the terms, concepts, methods, principles and experimental techniques of chemistry.

Course structure

The First Degree programme in Chemistry comprises of fourteen core courses, one project course, two elective courses, one core-specific foundation course in addition to one area-specific foundation course, the complementary courses and language courses. Among the two open/elective courses, the one offered in the fifth semester is open to students from other Majors. The details of the Course Structure are given in Table I. Table II gives the details of the contact hours and credits for the Core Courses, Foundation Course II, Open Course and Elective Course, Table III gives the details of Open Courses and Table IV gives the details of the Elective Courses and Table V gives distribution of Complementary Courses in different Semesters.

First Degree Programme in Chemistry

Table I : Course structure, Scheme of Instruction and Evaluation

Semester	Course Code	Study component	Instructional hrs/Week		Credit	Duration of Uty. Exam	Evaluation marks		Total Credit
			T	P			CE	ESE	
I	EN1111	English I	5		4	3hrs	20	80	18
	1111	Additional Language I	4		3	3hrs	20	80	
	EN1121	Foundation Course I	4		2	3hrs	20	80	
	MM1131.2	Complementary Course I	4		3	3hrs	20	80	
	PY1131.2	Complementary Course II	2		2	3hrs	20	80	
		Complementary Course Lab of PY1131.2		2	-	-	-	-	
	CH1141	Core Course I	2		4	3hrs	20	80	
		Core Course Lab I of CH1141		2	-	-	-	-	
II	EN1211	English II	4		3	3hrs	20	80	18
	EN1212	English III	5		4	3hrs	20	80	
	1211	Additional Language II	4		3	3hrs	20	80	
	CH1221	Foundation Course II	2	2	3	3hrs	20	80	
	MM1231.2	Complementary Course III	4		3	3hrs	20	80	
	PY1231.2	Complementary Course IV	2		2	3hrs	20	80	
		Complementary Course Lab of PY1231.2		2	-	-	-	-	

Contd……..

First Degree Programme in Chemistry Course structure, Scheme of Instruction and Evaluation

Semester	Course Code	Study component	Instructional hrs/Week		Credit	Duration of Uty. Exam	Evaluation		Total Credit
			T	P			CE	ESE	
III	EN1311	English IV	5		4	3hrs	20	80	18
	1311	Additional Language III	5		4	3hrs	20	80	
	MM1331.2	Complementary Course V	5		4	3hrs	20	80	
	PY1331.2	Complementary Course VI	3		3	3hrs	20	80	
		Complementary Course Lab of PY1331.2		2	-	-	-	-	
	CH1341	Core Course II	3		3	3hrs		80	
		Core Course Lab I of CH1341		2	-	-	-	-	
IV	EN1411	English V	5		4	3hrs	20	80	24
	1411	Additional Language IV	5		4	3hrs	20	80	
	MM1431.2	Complementary Course VII	5		4	3hrs	20	80	
	PY1431.2	Complementary Course VIII	3	2	3	3hrs	20	80	
	PY1432.2	Complementary Course Lab of PY1131.2, PY1231.2, PY1331.2 & PY1431.2			4	3hrs	20	80	
	CH1441	Core Course III	3		3	3hrs	20	80	
	CH1442	Core Course IV-Lab I of CH1141, CH1341 & CH1441		2	2	3hrs	20	80	

Contd........

Semester	Course Code	Study component	Instructional T	Instructional P	Credit	Duration of Uty. Exam	Evaluation CE	Evaluation ESE	Total Credit
V	CH1541	Core Course V	3		4	3hrs	20	80	
	CH1542	Core Course VI	4		4	3hrs	20	80	
	CH1543	Core Course VII	4		4	3hrs	20	80	
	CH1544	Core Course VIII Lab II		5	0	3hrs	20	80	
	CH 1545	Core Course IX Lab III		4	0	3hrs	0	0	
	1551	Open Course	3		2	3hrs	0	0	
		Project		2	-	-	-	-	14
VI	CH1641	Core Course X	3		4	3hrs	20	80	28
	CH1642	Core Course XI	4		4	3hrs	20	80	
	CH1643	Core Course XII	4		4	3hrs	20	80	
	CH1544	Core Course VIII Lab II		8	3	6hrs	20	80	
	CH 1545	Core Course IX Lab III			2				
	CH1644	Core Course XIII Lab IV			3	6hrs	20	80	
	CH1645	Core Course XIV Lab V			2				
	CH1661.1/ CH1661.2/ CH1661.3/ CH1661.4	Elective Course	3		2	3hrs	20	80	
	CH1646	Project and Factory Visit		3	4	Viva	-	100	

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A) Language Courses = 9, B) Foundation Courses = 2, C) Complementary Courses = 9, D) Core Courses = 14, E) Open Course = 1, F) Elective Course = 1, G) Project = 1 Total Courses = 9+2+9+14+1+1+1 = 37.
Total Credits = 18+18+18+24+14+28 =120.

B.Sc. Degree Programme in Chemistry

Table II. Scheme of Instruction of Core Courses, Foundation Course II, Open Course and Elective Course

Course number	Course Code	Course Title	Semester I			Semester I			Semester III			Semester IV			Semester V			Semester VI			Total	
			Hrs			credit			hrs		credit	hrs		credit	hrs		Credit	hours			Hrs	
			T	P		T	P		T	P		T	P		T	P		T	P	credit		credit
C.C. I	CH1141	Inorganic Chemistry I	2		4																2	4
F.C. II	CH1221	Methodology and Informatics				2	2	3													4	3
C.C. II	CH1341	Inorganic Chemistry II							3		3										3	3
C.C. III	CH1441	Organic Chemistry I										3		3							3	3
C.C. IV	CH1442	Lab I of CH1141,CH1341,CH 1441(Inorganic Qualitative Analysis)		2						2			2	2							6	2
C.C. V	CH1541	Physical Chemistry I													3		4				3	4
C.C. VI	CH1542	Inorganic Chemistry III													4		4				4	4
C.C. VII	CH1543	Organic Chemistry II													4		4				4	4
C.C. VIII	CH1544	Lab Course II of CH1541, CH1542 & CH1543 (Inorganic volumetric analysis)														5	3				5	3
C.C. IX	CH1545	Lab Course III of CH1541, CH1542 & CH1543 (Physical chemistry experiments)														4	2				4	2
O. C	CH1551	Any One of the Options													3		2				3	2
C.C. X	CH1641	Physical Chemistry II																3		4	3	4
C.C. XI	CH1642	Organic Chemistry III																4		4	4	4
C.C. XII	CH1643	Physical Chemistry III																4		4	4	4
C.C. XIII	CH1644	Lab Course IV (Organic chemistry experiments)																	5	3	5	3
C.CXIV	CH1645	Lab Course V (Gravimetry)																	3	2	4	2
E.C.	CH1661	Any one of the options																3		2	3	2
C.C.XV	CH1646	Project														2			3	4	5	4
		Factory Visit																				

C.C.- Core Course, F.C.-Foundation Course, O.P.-Open Course, E.C- Elective Course T-Theory, P-Practical.
Since the other requirements as the components of continuous evaluation are satisfied, for each of the practical courses in semester V is given a credit of 2 even though the examinations are on semester 6.

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Table III. Distribution of Open Course offered to students of other disciplinesSemester V

Semester	No. of Hours / Week		Credits	Course Code	Title of the Course	Instructional Hours
	Lectures	Practicals				
5	3	-	2	CH1551.1	Essentials of Chemistry	54
				CH 1551.2	Fundamentals of Chemistry & Its Application to Everyday Life	
				CH 1551.3	Environmental Chemistry	

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Table IV. Distribution of Elective Course offered in Semester VI

Semester	No. of Hours / Week		Credits	Course Code	Title of the Course	Instructional Hours
	Lectures	Practicals				
6	3	-	2	CH1661.1	Supramolecular, Nano Particles and Green Chemistry	54
				CH 1661.2	Computational, Combinatorial and Physical Organic Chemistry	
				CH 1661.3	Polymer chemistry	
				CH 1661.4	Biochemistry	

Table V

Distribution of Complementary Courses in different SemestersComplementary Courses -4
Total Credits – 14One Semester – 18Weeks

Sem	Hours/Week Theory	Practical	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131		2×18 = 36 2×18 = 36
2	2	2	2	CH1231		2×18 = 36 2×18 = 36
3	3	2	3	CH1331		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 CH1432		3×18 =54 2×18 = 36

GENERAL ASPECTS OF EVALUATION

MODE OF EVALUATION - COMMON TO CORE, ELECTIVE, COMPLEMENTARY AND FOUNDATION COURSES

Evaluation of each course shall involve Continuous Evaluation (CE) of 20 marks and End Semester evaluation (ESE) of 80 marks .

CONTINUOUS EVALUATION FOR LECTURE COURSES

The Continuous evaluation will have 20 marks and will be done continuously during the semester. CE components are

(i) Attendance for lecture and laboratory sessions (to be noted separately where both lecture and laboratory hours have been specified within a course);

(ii) Assignment /seminar and

(iii) Test

The weightage is shown in Table I.1. There will be two class tests for which, the better of the two marks obtained will form part of CE. Seminar for each course to be organized by the course teacher and assessed along with a group of teachers in the Department. The topic selection by the student for assignments/seminar will be with the approval of the course teacher.

No	Component	Marks
1	Attendance	5
2	Assignment / Seminar	5
3	Tests	10
	Total	20

EVALUATION OF THE ASSIGNMENTS AND SEMINAR

The assignment typed/written on A4 size paper should be 4-6 pages. The minimum duration of the seminar is fifteen minutes and the mode of delivery may use audio-visual aids if available. The seminar is to be conducted within the contact hour allotted for the course.

<table>
<tr><th colspan="3">Mode of Assignments / Seminar Evaluation</th></tr>
<tr><th>No</th><th>Main Component</th><th>Marks</th></tr>
<tr><td>1</td><td>Adherence to overall structure &submission deadline</td><td rowspan="4">All four main components present &satisfactory : 5
Only three : 4
Only two : 3
Only one : 2</td></tr>
<tr><td>2</td><td>Content & grasp of the topic</td></tr>
<tr><td>3</td><td>Lucidity / Clarity of presentation</td></tr>
<tr><td>4</td><td>References / Interaction/Overall effort</td></tr>
</table>

The following explanatory guide lines in Table I.1.1.1 are suggested tentatively for the assessment of each of the above main components as satisfactory or not.

QUESTION PAPER PATTERN FOR CONTINIOUS EVALUATION TEST

1. The theory examination has a duration of 1.5 hours and a maximum mark of 40
2. Each question paper has three parts: A, B & C
3. Part A contains ten questions. Each question carries 1 mark. Students have to answer all 10 questions. The answer may be in the forms – one word/one sentence.
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer 7 questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Part C contains nine questions of which the candidate has to answer 4 questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).

Question paper should contain 20% hard,60% medium and 20% easy questions

QuestionPaperPatternforTest		
QuestionNo	*Typeof Question*	*Marks*
Part A: 1-10	All / one word/one sentence	1X10=10
Part B: 11-22	7out of 12; Short Answer	7 X2=14
Part C: 23-31	4 out of 9; Short Essay	4 X4= 16
TOTAL	1 out of 2; Essay	40 marks

CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation will have 20 marks. The ESE of inorganic qualitative analysis will be done only in the IV semester and similarly the ESE of physical chemistry experiments and volumetric analysis will be done only in the VI semester. But the corresponding CE are calculated from all the semesters in which there is attendance for laboratory sessions.

No	Component	Marks
1	Attendance	5
2	Lab test	5
3	Record	5
4	Punctuality	5
	Total	20

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I. 2. 1. EVALUATION OF THE RECORD

On completion of each experiment, a report should be presented to the course teacher as soon as the experiment is over. It should be recorded in a bound note-book and not on sheets of paper. The experimental description should include aim, principle, materials/apparatus required/used, method/procedures, and tables of data collected, equations, calculations, graphs, and other diagrams etc. as necessary and final results. Careless experimentation and tendency to cause accidents due to ignoring safety precautions will be considered as demerits.

CE for Laboratory Record		
No	Sub Component	Marks
1	Punctual submission and Neat presentation	All four sub-components present &satisfactory : 5 Only three : 4 Only two : 3 Only one : 2
2	Record of more than 90% experiments in the syllabus	
3	Calculations and absence of errors/mistakes	
4	Accuracy of the result	

During ESE external examiner has to verify that the Lab report of experiments and certified by the tutor and HOD

END SEMESTER QUESTION PAPER PATTERN & GUIDELINE FOR QUESTION PAPER SETTERS

1. The theory examination has a duration of 3 hours
2. Each question paper has four parts: A, B , C and D
3. Part A contains ten questions. Student have to answer all 10 questions. Each question carries1mark. The answer may be in the forms – one word/one sentence.
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer eight questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Part C contains nine questions of which the candidate has to answer six questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).
6. Part D contains four questions of which the candidate has to answer two. Each question carries 15marks.Essay type question. Each question carries two or three subdivisions (10+5) or (5+5+5) pattern.
7. The total weightage for the entire questions to be answered is 80 marks.
8. Question paper should contain 20% hard,60% medium and 20% easy questions.
9. Question paper setter shall submit a detailed scheme of evaluation along with question paper.
10. Question paper setters should refer standard text books for setting question papers, based on the syllabus.

QuestionPaperPatternforTest		
QuestionNo	*TypeofQuestion*	*Marks*
Part A: 1-10	10 one word/one sentence	10

Part B: 11-22	8 out of 12; Short Answer	16
Part C: 23-31	6 out of 9; Short Essay	24
Part D: 32-35	2 out of 4; Essay	30
		Total = 80-80 marks

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Semester – I Core Course - 1 Course Code– CH1141 Credit-4

Inorganic Chemistry I

Lecture -Tutorial-Lab: 2-0-2 *36hrs.*

Aim of the Course

The course builds on the plus-two level introductory chemistry and familiarizes theoretical aspects of atomic structure and periodicity. Subsequently, it delves into the principles of acids, bases and nonaqueous solvents. The course will be highlighting the chemistry of hydrogen as well as s-block elements. The course also introduces the students an idea about environmental chemistry and different types of pollution.

Course objectives

The course helps to learn the students to understand the structure of atom, periodicity and non-aqueous solvents. Upon course completion, the student will be able to appreciate how the inner structure of elements dictates the chemical properties of elements and also understand how the elements are arranged in the periodic table and the properties and application of s -block elements, hydrogen and their compounds.

Course outline

Module I- Atomic Structure and Periodicity *6 hrs.*

Introduction to the structure of atom - Dual nature of electron - de Broglie equation - matter waves and electromagnetic waves - experimental verification of de Broglie relation - Heisenberg's uncertainty principle - expression and significance. Wave mechanical concept of the atom - Schrodinger equation (Derivation not required) -. Quantum numbers - Pauli's exclusion Principle - Aufbau Principle – Hund's rule - Electronic configuration of atoms - classification of elements into s, p, d, f blocks - electronegativity- Pauling's scale, Mulliken and Allred - Rochow scale-(Including numerical problems)

Module II-Hydrogen 6hrs

Position of hydrogen in the periodic table. - Similarities and difference in properties compared with alkali metals and halogens- Atomic and physical properties of hydrogen; Preparation of hydrogen- Reactions of hydrogen. Nascent, atomic and active hydrogen- Ortho and para hydrogen -Deuterium and tritium –Uses of hydrogen- Hydrogen as next generation fuel-Hydrides- Types of hydrides, properties; water; Hydrogen bond-types-consequences of hydrogen bond. Hydrates; Hardness of water- types- different methods water softening. Heavy water- preparation and properties.

Module III-S-Block Elements 9hrs

General characteristics, atomic and ionic radii, ionisation enthalpy, electropositive character, formation of univalent positive ions, hydration of ions, reducing properties, Electrode potentials, characteristic flame colouration, lattice enthalpy, chemical properties, , comparison of lithium with other members of the family, resemblance of lithium and magnesium, uses of alkali metals, properties of alkali metals and their uses, compounds of elements of group 1 – comparative study-oxides, hydroxides, halides, carbonates and bicarbonates General characteristics of group II-atomic and ionic radii, ionisation enthalpy, reducing properties, electrode potentials, characteristic flame colouration, chemical properties, gradation in properties, comparison of beryllium with other members of the family, Uses of alkaline earth metals, Compounds of alkaline earth metals-Beryllium oxide, beryllium chloride, calcium oxide, calcium hydroxide, calcium cyanamide- preparation and properties. comparison of solubility products of hydroxides and sulphates, Portland cement.

Module IV -Acids, Bases and Non Aqueous Solvents *6hrs*

Lowery-bronsted and Lewis concepts of acids and bases-introduction to SHAB principle. General properties- classification- self ionization and levelling effect- reaction in non-aqueous solvents - protic and aprotic non aqueous solvents- examples- solutions of metals in liquid ammonia- self ionization of liquid ammonia- liquid SO_2, liquid HF, alkali metals in liquid ammonia

Module V - Environmental Chemistry – Air, Water and Soil Pollution *9 hrs.*

Air pollution - ozone layer depletion, ozone hole, protection of ozone umbrella –Air pollution caused by fire works, harmful effects of fireworks, acid rain, green house effect, smog –Classic and photochemical Smog-management of air pollution.

Water pollution: Causes- Heat, industrial waste, sewage water, detergents, agricultural pollutants - treatment of industrial waste water-Activated charcoal, Synthetic resin, reverse osmosis and electro dialysis - Quality of drinking water - Indian standard and W H O standard - Dissolved oxygen - BOD, COD.

Soil pollution - Pesticides, Fertilizers, Industrial waste, plastics - Control of pollution

References

1. T.F.Gieryn, Cultural boundaries of science Univ. Chicago Press 1999.
2. The Golem : What everyone should know about science. H.Collins and T.Pinch. Cambridge Univ Press 1993
3. Alexis Leon & Mathews Leon, Computers Today, Leon Vikas
4. SotiSivendraChanthra Contemporary Science Teaching,
5. ManasChanda, "Atomicstructure and Chemical Bonding including Molecular spectroscopy"
6. E.S. Gilreath "Fundamental concepts of Inorganic Chemistry"
7. Puri, Sharma and Kalia "Inorganic Chemistry"
8. Madan "Inorganic Chemistry".
9. Manku , "Theoretical principles of Inorganic Chemistry" -
10. M. C. Dey and J. Selbin "Theoretical Inorganic Chemistry".
11. F A Cotton and G. Wilkinson "Basic Inroganic Chemistry".
12. S. K. Banerji, "Environmental Chemistry".
13. A. K. De "Environmental Chemistry - An introduction"
14. B. K. Sharma "Air Pollution".
15. V. K. Ahluwalia "Environmental Chemistry"
16. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A global perspective"
17. Puri, Sharma and Kalia "Inorganic Chemistry"

University of Kerala

Model Question Paper of B.Sc. Chemistry Programme

2017 onwards

Semester -I Core Course-1 Course Code - CH1141 Credit-4INORGANIC CHEMISTRY ITime: Three Hours

Maximum Marks: 80

SECTION A (Answer all questions in one word/one sentence. Each question carries 1 mark)

1. Mention about the flame colouration of II group elements.
2. Write an example of classic smog.
3. State Heisenberg's uncertainty principle.
4. What are matter waves?
5. Which is the conjugate base of HF.
6. Define covalent radius.
7. Write the reason for eutrophication?
8. In the stratosphere, fluorine from the CFC's change to which compound.
9. What is active hydrogen?
10. Mention any use of alkali metals.

(1 X 10 = 10marks)

SECTION B (Answer any 8 questions. Each question carries 2 Marks)

11. Calculate the wavelength of electron moving with a velocity of 10^6 ms^{-1}.
12. A cricket ball weighing 100g is to be located within 0.1A^o. What is the uncertainty in its velocity?
13. What are eigen values and eigen functions?
14. How first element differs from other elements in a group?
15. What is COD?
16. What are ortho and para hydrogens.
17. Write SHAB principle?
18. Comment about the hydration of alkali metals?
19. State and illustrate Pauli's Exclusion Principle.
20. Distinguish between levelling solvents and differentiating solvents.
21. Write a note on green house effect.
22. What is acid rain? Explain the various types of hydrogen bonds.

(2 X 8 = 16marks)

SECTION C (Answer any 6 questions. Each question carries 4 Marks)

23. Discuss the following reactions in liquid SO_2?(i) Solvation (ii) acid- base reaction
24. Discuss the structure of beryllium chloride
25. Derive Schrodinger wave equation.
26. Briefly explain about the Davisson and Germer's experimental verification of wave nature of electron.
27. What is smog? What are the different types of smog?
28. How ozone layer is depleted?
29. What is the trend of Ionization enthalpy and electron gain enthalpy in the periodic table?
30. What are hydrides? Explain.
31. Discuss about the redox property of alkali metals

(4 X 6 = 24marks)

SECTION D

(Answer any 2 questions. Each question carries 15 Marks)

32.(a) Briefly discuss about the various air pollutants (5 Marks)

(b) Write a note on Ozone depletion (5 Marks)

(c) Explain about the various water quality parameters (5 Marks)

33.(a) What are quantum numbers? Explain (5 Marks)

(b) Write a note on various electronegativity scales (5 Marks)

(c) Explain about the various rules for writing electronic configuration. (5 Marks)

34.(a) What is the difference between inter and intra molecular hydrogen bonding with example.

(b) Discuss the topic hydrogen as next generation fuel

(c)Liquid ammonia is a better solvent for organic compounds. Why?

35.(a) What are the common characteristics of solvents?

(b) Discuss the various methods for removal of permanent hardness

(c) Compare the solubility products of hydroxides and sulphates of alkaline earth metals.

(15 X 2 = 30marks)

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

SEMESTER- II Foundation Course – II COURSE CODE- CH1221 Credit-2

Methodology and Perspectives of Sciences and General Informatics 36Hours

Lecture-Tutorial-Lab: 2-0-2 hours per week; eighteen 5-day weeks per semester. Contact hours per semester: 36 hrs lecture and 36 hrs related lab instruction.

Aim of the Course

The aim is to familiarize the student with the methodology and perspectives of Science and the importance of Science in the development of culture. The course introduces the student to the history of evolution of chemistry as a major branch of science. The course also focuses the various elementary aspects of research in chemistry. The contents emphasize the role of informatics in understanding Chemistry and to learn computer based application in analysis and presentation of experimental data.The course also focuses the various elementary aspects of analytical principles and safety measures in the laboratory.

Objective of the Course

On completion of the course the students will be able to understand how Science or in special Chemistry works. They will get a basic understanding to do self-directed experimentation work and research in chemistry under the guidance and supervision of a mentor. Analytical chemistry helps the students to understand about the experimental parts of the theory and the safety measures which could follow when doing experiments using chemicals.

Course out line

Module – 1 : Methods and Tools of Science & Experimentation in Science ------6 Hrs

Laws of science – Basis for scientific laws and factual truths -hypothesis – observations and proofs. Revision of scientific theories and laws. Importance of models, simulations and virtual testing in chemistry-Design of an experiment – experimentation - observation – data collection – types of data – examples-interpretation and deduction –repeatability and replication-units and dimensions,unit conversions . Documentation of experiments – record keeping

Module II – Evolution of Chemistry as a discipline of science ----------6Hrs

Evolution of Chemistry - ancient speculations on the nature of matter, early form of chemistry-alchemy, Robert Boyle and the origins of modern chemistry in the latter 1600s - Antoine Lavoisier and the revolution in chemistry -Chemical atomism—background and thought of John Dalton. Atom models- Daltons, J. J. Thomson, Rutherford, Bohr model – Major contributions of Friedrich Wöhler, Mendeleev, Michael Faraday and Marie Skłodowska-Curie. Structure of chemical science: scope of chemical science, branches of chemistry. Basic ideas of interdisciplinary areas involving Chemistry

Module III Research in Chemistry 6 Hrs

Selecting a topic – hypothesis- Design of an experiment –- observation – data collection – experimentation. Documentation of experiments – nature and types of data – typical example. interpretation and deduction – necessity of units and dimensions – Accuracy and precision, variables, correlation and causality, sampling, use of controls, experimental bias, analysis, results, discussion of results, models., statistical analysis of experimental data using computers, mean, mode, deviation, standard deviation. -Plotting graph, preparation of seminar papers, project. using computers.

Study of latest Nobel prize topics in chemistry (only one in the year of study of S2 course from Nobel web site).

Module IV – Overview of Information Technology & Introduction to Cheminformatics 6 Hrs

Features of the modern personal computer and peripherals computer network and internet – Operating systems and softwares. Data information and knowledge. Knowledge management – Internet as a knowledge repository, Creating your cyber presence – open access. – Open active publishing models – Basic concepts of IPR, copy right and patents – plagiarism – Cybercrime. Introduction to use of IT in teaching and learning process – Educational softwares – INFLIBNET, NICNET, BRNET, NPTEL, VIRTUAL LABS OF MHRD academic services (elementary level only).

Basics of cheminformatics, applications of cheminformatics, storage & retrieval, file formats – MOL, SDF, CML,PDB formats, SYBYL Line Notation, SMILES of simple molecules like methane, benzene , cyclohexane. Structure drawing, spread sheet and chemistry related softwares. Molecular visualization tools. Chemical Databases.

Module V - Analytical Principles 6 hrs.

Inorganic qualitative analysis - Common ion effect - solubility product - precipitation of cations. Microscale analysis – Advantages

Quantitative Analysis - Theory of titration - acid-base, redox, precipitation and complexometric titrations. Theory of indicators - acid-base, redox, adsorption and metallochromic indicators.

Chromatography - classification of methods - Elementary study of adsorption chromatography Column and thin layer- partition chromatography-paper- ion exchange and gas chromatographic methods.

Module VI - Gravimetric Analysis&*Safety measures in Laboratory* *6 hrs.*

Gravimetric Analysis - Mechanism of precipitate formation - Factors affecting solubility of precipitates – co-precipitation and post precipitation - Effect of digestion - washing, drying and ignition of precipitates.

Introduction to lab safety-regulatory requirements-labels, material safety.Knowledge of hazard warning information and symbols. Explosive compounds(idea), potentially dangerous mixtures- Fire hazards(idea about flammable solvents, ignition sources used in laboratories, metal hydrides),Emergency procedures in chemical splashes to skin and eyes, burns and electric shock.

Reactive inorganic reactants and their toxicity (strong acids, bases, halogens, chromates). Hazards due to chemicals, toxic- solids, liquids, gases, and other harmful substances - carcinogenic substances.

References

1.T.F.Gieryn, Cultural boundaries of science Univ. Chicago Press 1999.
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26.Vogel's text book of practical organic chemistry new edition
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University of Kerala
Model Question PaperofB.Sc.Chemistry Programme
2017onwards

SemesterII Foundation Course 2Course Code CH1221 Credit-2 Methodology and Perspectives of Sciences and General Informatics Time:Three Hours

Maximum Marks:80

Section- A

Each question carries one mark

Answer all Questions. Answer in one word / sentence. Each question carries 1 mark.

1.Who is the father of modern chemistry?
2.Define null hypothesis.
3.What is NPTEL?
4.What you meant by plagiarism?
5.What are the contributions of Dmitri Mendeleev?
6.What are variables?
7.Define common ion effect
8.What are redox indicators?
9.Define accuracy
10. Write the name of two toxic chemicals used in chemistry laboratory.

Section B (short answer type)

(Answerany8questionsfromthefollowing. Each answer carries 2 mark)

11. What is co-precipitation?
12. Define standard deviation.
13. Write a short note on a chemical which is skin irritant.
14. What is meant by data representation?
15. Name four chemistry related softwares?
16. Mention the toxicity of strong acids
17. What is a chemical database?
18. Explain basic concepts of IPR?
19. What are the features of modern personal computer?
20. What are acid base indicators ?
21. What is TLC?
22. Which are the factors affecting solubility of precipitates. Section C (Short essay type)

Answer any 8 from the following. Each question carries 4 marks.

23. What is meant by revision of scientific theories and laws?
24. Explain documentation of experiments.
25. Explain the applications of cheminformatics.
26. Explain copy right and patents.
27. Explain enquiry vs discovery approach?
28. Discuss about the carcinogenic chemicals used in the laboratory.
29. What is the scope of chemical science?
30. Write a short note on the theory of an acid base indicator
31. Explain the principleof gravimetric titration with an example.

Section D.

Answer any 2 from the following. Each question carries 15 marks

32. (a)Explain the various types of file formats .(5 marks)
(b)databases used in cheminformatics ? (5 marks)

(c)Write the SMILES of Methane, Benzene and cyclohexane. .(5 marks)

33. (a) Discuss about chemical safety.
 (b) Discuss about the theory of titration.
 (c) Write a note on the knowledge of hazard warning informations.

34.(a) Write a short note on the evolution of modern chemistry.
 (b) Write a note on induction-deduction methods in knowledge transfer process.

35.(a) Explain the applications of common ion effect and solubility product in analysis of cations. (10 marks)
 (b)Write a short note on method to avoid accidents in chemical laboratory. (5marks)

B.Sc. Chemistry Programme
Semester-3 Course-II Course Code – CH1341 Credit-3
Inorganic Chemistry- II 54 hrs

Lecture-Tutorial-Lab: 3-0-2 hours per week; eighteen 5-day weeks per semester. Contact hours per semester: 56 hrs lecture and 36 hrs related lab instruction.

Aim of the Course

The course is emphasized to provide fundamental to detailed knowledge in chemical bonding and compounds of non-transition elements. The course is designed to provide the students the fundamental knowledge of the nanomaterials. The course also describes about the various applications of nuclear chemistry.

Objectives:The objective of this course is to provide a necessary foundation for inorganic chemistry. This course build a thorough knowledge in chemical bonding and compounds of non-transition elements and gives an elementary idea about nanomaterials. It aims to lay a strong foundation in the area of nuclear chemistry.

Course out line

Module-1 Chemical Bonding –I *9hrs*

Concept of resonance, formal charges. VSEPR theory and its applications - structure of molecules with bond pairs only, molecules with both bond pairs and lone pairs . -Valence bond theory-Conditions for overlapping-Types of overlapping (positive, negative and Zero overlapping), - hybridization - methane, ethylene, benzene, acetylene,allenes, sp^3d and sp^3d^2– Limitations of VBT

MO theory, LCAO, homonuclear diatomic molecules- C_2, B_2, N_2, O_2 and ions like O_2^+- heteronuclear diatomic molecules (HF, NO, and CO) – Bond order - comparison of VB and MO theories

Module II : Chemical Bonding –II *9hrs*

Ionic bond-ionic lattice energy of ionic compounds- Bond-Lande equation, BornHaber cycle, solvation energy and solubility of ionic solids-covalent character of ionic bond, Fajan's rules

Polarity of Covalent bond- dipole moment- percentage ionic character- dipole moment and molecular structure

Metallic bonding- free energy theory, VB theory and band theory (Qualitative treatment only)-Secondary forces – hydrogen bond, inter and intramolecular hydrogen bond, intermolecular interaction –-

ion –dipole van der Waals forces such as dispersion forces, dipole-dipole, ion-induced dipole, dipoleinduced dipole

Module III Compounds of non-transition elements I *(9 hrs)*

Manufacture and uses of the following Glass – different types of glasses, Silicates, Zeolites and Silicones. Borax - boron hydrides, boron nitrides, borazole and carboranes. Oxides and oxyacids of phosphorus. Refractory carbides, nitrides, salt-like carbides, borides, and silicides.

Module IV Compounds of non-transition elements II (9 hrs)

Oxides and oxyacids of halogens (structure only) – Inter halogen compounds and pseudo halogens – Compounds of noble gases (Xenon and Radon)– Uses of noble gases.
Inorganic polymers Phosphorus, boron and silicon based polymers – Structure and industrial applications.

Module V: Nuclear Chemistry (9hrs)

Natural radioactivity, modes of decay, decay constant(Derivation not expected), half life, average life, Disintegration series. Geiger –Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, packing fraction, mass defect and binding energy, Nuclear models –Shell model and liquid drop model. nuclear fission-atom bomb and nuclear fusion-hydrogen bomb-applications of radioactivity- ^{14}C dating, rock dating neutron activation analysis and isotope as tracers. Study of reaction mechanism (ester hydrolysis)-application of radioactive isotopes in medicine - Radio diagnosis and radiotherapy. (Including numerical problems)

Module VI : Chemistry of Nanomaterials *(9hrs)*

Evolution of Nanoscience – Historical aspects- Preparations containing nano gold in traditional medicine. Lycurgus cup- Faraday's divided metal etc. Nanosystems in nature. Preparation of nanoparticles: Top-down approaches and Bottom to top approach Sol–gel synthesis, Colloidal precipitation, Co–precipitation, Combustion technique, Sonochemistry, Hydrothermal technique, High energy ball milling etc. Carbon nanotubes and fullerenes. Properties of nanoparticles: optical, magnetic, mechanical, thermal and catalytic properties with examples.

Reference:

1. "Basic Inorganic Chemistry" ; F. A. Cotton, G. Wilkinson and P. L. Gaus, Willey
2. "Concise Inorganic Chemistry" : J. D. Lee, ELBS
3. "Theoretical Inorganic Chemistry" : M. C. Day and Selbin
4. "Inorganic Chemistry- Principles and Structure and Reactivity" : J. E. Huheey
5. "Inorganic Chemistry" : Shriver and Atkins
6. "Coordination Chemistry" :Bosolo and Johnson
7. "Coordination Chemistry" : S. F. A. Kettle
8. "Inorganic Chemistry" : J. E. Hueey

9 . Essentials of Nuclear Chemistry : H S Arniker 10.
Puri, Sharma and Kalia "Inorganic Chemistry"
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Model Question Paper of B.Sc. Chemistry Programme
2017 admissions onwards
Semester -III Core Course-II Course Code – CH1341 Credit-3INORGANIC CHEMISTRY IITime: Three Hours
Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. What is the bond order of O_2^+.
2. What is fullerenes?
3. What are nano sensors?
4. Name the hydrogen bonding in salicylaldehyde.
5. What is inorganic benzene?
6. Write an example for inter halogen compound.
7. Example for phosphorus based polymer.
8. Name a naturally occurring radioactive element.
9. Write an example of carboranes?
10. What is zeolite.

SECTION B

(Answer any 8 questions. Each question carries 2 Marks)

11. Compare the properties of Borazole with benzene
12. Explain the method of preparation of gold nano particles
13. Applications of nano particles in medicine and electronics
14. Write a note on Fajans rule
15. Calculate the bond order of N_2, B_2, C_2 and O_2
16. What are the limitations of VBT?
17. Explain the structure of diborane
18. What is lattice energy?
19. State Geiger –Nuttal rule.
20. What are carboranes ?
21. Write a note on Born-Haber cycle
22. What is nuclear fission ?

SECTION C

(Answer any 6 questions. Each question carries 4 Marks)

23. Draw the MO diagram for NO and C_2 molecule
24. Give a comparative account of VB and MO theories using relevant examples.
25. What is meant by dipole moment? How it is helpful in explaining the structure of molecules.
26. Write a note on the preparation of nano particles using sol-gel method.
27. Explain the optical, magnetic, thermal and catalytic properties of nanoparticles with examples.
28. Write the hybridisation and structures of Xenon compounds.
29. Explain artificial transmutation with example.
30. Explain mass defect.
31. Write a note on the manufacture of glasses.

SECTION D

(Answer any 2 questions. Each question carries 15 Marks)

32.(a) Explain VSEPR theory with example (5 marks)

(b) Write a note on solvation energy and solubility of ionic solids (5 marks)

(c) Write a note on secondary bond forces (5 marks)

33. (a) Explain the optical, magnetic, thermal and catalytic properties of nanoparticles with examples (b) Write a note on radio carbon dating.

34. (a) Write a note on the manufacture of glass.

(b)Explain the preparation and bonding of noble gases.

35. (a) Write a note on carbon nanotubes and fullerenes

(b) Explain inorganic polymers

(c) Write a note on band theory

SEMESTER – IV (Core Course – 3) Credit – 3 Course Code – CH1441

Organic chemistry Paper – I Total : 54 hours

Lecture - Tutorial – Lab: 3-0-2

Aim of the Course: The syllabus includes introduction to classificaion, nomenclature, mechanism of reactions, aromaticity and the chemistry of aliphatic and aromatic substituted compounds. The course also describes the stereochemistry of organic compounds.

Objective of the Course: It imparts the behaviour of aliphatic and aromatic compounds and introduces the concept of reaction mechanism. Make the students to understand the mechanism of reactions of organic compounds, stereo chemical aspects, photochemical reactions and aromaticity.

Module I: Introduction to organic chemistry (3 hours)

Uniqueness of carbon – classification of organic compounds – Functional groups (mention only) Review of basic rules of IUPAC nomenclature and IUPAC naming of organic compounds.
Types of reagents: Electrophiles and Nucleophiles.
Types and subtypes of organic reactions: Substitution, addition. Elimination and rearrangement (definition and simp le examples only).

Module II :Introductin to organic reaction mechanism: (9 hours)

Definition of reaction mechanism.
Drawing of electron movements with arrows – curved arrow notation. Half headed and double headed arrows. Nature of bond fissions :Homolysis and heterolysis.
Electron displacement effects: Inductive effect, electromeric effect, mesomeric effect, resonance, hyperconjugative and steric effects.
Acidity and basicity of organic compounds based on inductive and resonance with reference to acid characters of alcohols, phenols and carboxylic acids and basic character of aliphatic and aromatic amines.
Applications of hyperconjugative effect – stability of alkenes, alkylbenzenes, free radicals and carbocations.

Reaction intermediates: Carbocations, carbanions, free radicals and carbenes (definition, hybridization, structure, classification, formation, stability and important reactions) – rearrangement of carbocations – nitrenes(mention only).

Introduction to pericyclic reaction – Electrocyclic, cycloaddition and sigmatropic reactions.

Module III : Reaction Mechanism II (9 hours)

Aliphatic nucleophilic substitutions, mechanism of SN1 and SN2 reactions – Effect of structure, substrate, solvent, nucleophile and leaving goups. Stereochemistry – Walden Inversion.
Elimination reaction: Hoffmann and Saytzeff rule – cis and trans eliminations – mechanisms of E1 and E2 reactions. Substitution vs Elimination.

Addition reactions – mechanism of addition of bromine and hydrogen halides to double bonds – Markownikoff's rule and peroxide effect. Cis-hydroxylation.
Elimination – Addition mechanism – Benzyne intermediate.

Methods of determination of reaction mechanism – product analysis, intermediates, isotopic effect, kinetic and stereochemical studies.

Module IV: Stereochemistry I (6 hours)

Representation of organic molecules: Fischer, Flying wedge, Sawhorse and Newman projection formulae.
Conformational isomerism – conformation – Dihedral angle – Torsional strain – conformational analysis of etha ne and n-butane including energy diagrams – Baeyer's strain theory – Sache-Mohr theory of strainless rings – conformation of cyclohexane (chair, boat and skew boat forms) – axial and equatorial bonds – ring flipping – conformers of mono and dialkyl substituted cyclohexanes.

Module V: Stereochemistry II (9 hours)

Optical Isomerism : Chirality and elements of symmetry – DL notation – Enantiomers – optical isomerism in glyceraldehydes, lactic acid and tartaric acid – Diastereoisomers – mesocompounds – Cahn-Ingold-Prelog rules – R-S notations for optical isomers with one and two asymmetric carbon atoms.- erythro and threo representations. Racemic mixture – resolution – methods of resolution.
Enatiomeric excess – Introduction to asymmetric synthesis

Optical activity in compounds not containing symmetric carbon atoms – biphenyls and allenes.
Geometrical isomerism – cis-trans, syn-anti and E-Z notations – geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes – methods of distinguishing geometrical isomers using melting point, dipolemoment, dehydration and cyclisation.

Module VI: Organic photochemical reactions and Dyes (9 hours)

Introduction – photochemical vs thermal reactions
Photochemical reactions of olefins: Photosensitization and photodimerisation
Photochemistry of carbonyl compounds: Norrish I, Norrish II cleavages. Photo reduction (Benzophenone to benzopinacol)

Dyes – Theory of colour and constitution – classification according to structure and method of application. Preparation and uses of methyl orange, congored, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo.

Module VII :Arenes and Aromaticity (9hours)

Heat of hydrogenation and heat of combustion of benzene – structure of benzene, naphthalene and anthracene – Concept of aromaticity – Huckel's rule – Application to benzenoid and nonbenzenoid compounds.

Reactions – Mechanism of electrophilic substitution in benzene – halogenation, nitration, sulphonation and Friedel Craft's alkylation and acylation – energy profile diagram.

Ring activating and deactivating groups with examples – orientation effect in monosubstituted benzene - –OH, $-NH_2$, NO_2, $-CH_3$ and halogens.

Aromatic nucleophilic substitution – bimolecular displacement mechanism – Elimination-Addition mechanism. Reactivity and orientation in Aromatic Nucleophilic substitution.

Reactivity of naphthalene towards alkylation, nitration and sulphonation. Carcinogenic polynucleararenes

References

(1) A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand& Company, New Delhi.
(2) L.G.Wade Jr, Organic Chemistry, Pearson Education, New Delhi.
(3) K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
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(6) D.Nasipuri, Stereochemistry of Organic Compounds: Principles and Applications, New Age International Publizhers, New Delhi.
(7) P.S.Kalsi, Organic Reactions, Stereochemistry, and Mechanism, New Age International Publishers, New Delhi.

(8) R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
(9) P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
(10) Peter Sykes, A Guide Book to Mechanism in Organic Chemistry, Pearson Education, New Delhi.
(11) J.Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
(12) G.M. Louden, Organic Chemistry, Oxford University Press, New York.
(13) E.L.Eliel, Stereochemistry of Carbon compounds, Tata McGraw Hill Publishing House, New Delhi.
(14) Jagadamba Singh and Jaya Singh, Photochemistry and Pericyclic rections, New Age International, New Delhi.
(15) J.March, Advanced Organic Chemistry, John Wiley & Sons., NY.
(16) S.M.Mukerji and S.P.Singh, Reaction Mechanism in Organic Chemistry, McMillan Publishers.
(17) I L Finar, "Organic Chemistry" Vol – 1, 5th Edition, Pearson Education, NewDelhi

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER IV Core Course III Course Code CH1441Credit-3
ORGANIC CHEMISTRY I

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. What is the product formed when a bond undergoes homolytic fission?
2. Give one example for each (i) substitution reaction and (ii) elimination reaction.
3. Write an example for electrocyclic reaction.
4. Name two reagents used for cis-hydroxylation.
5. What the products obtained when naphthalene undergoes sulphonation at different temperatures?
6. Identify the orienting effect of the following functional groups $–CH_3$, $-NO_2$, -CHO and –OH.
7. What are chromophores?
8. What are conforms?
9. What is geometrical isomerism?
10. Explain the term chirality. (1 X 10 =10 Marks)

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. What are electrophiles and nucleophiles? Give examples
12. Write the structure of the following compounds (i) 3,3,4-trimethyl-4-heptene (ii) 2-ethyl-3-methyl hexanal.
13. Phenol is acidic while ethanol is not. Why?
14. Arrange the following in the decreasing order of stability. Justify your answer.
$(CH_3)_2CH^+, CH_3^+, (C_6H_5)_2CH^+, C_6H_5CH_2^+$
15. Give an example and state Hofmann rule.
16. What is Walden Inversion?
17. What is Kharasch effect? Illustrate with an example.
18. When toluene is nitrated the major products are ortho and para substituted products. Why?

19. Define Huckel's rule.
20. Explain photosensitization with an example.
21. What is enantiomeric excess?
22. Explain with examples the importance of dipole moment measurements in distinguishing geometrical isomerism.

(2 X 8 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. What is inductive effect? How is it affect the acidity and basicity of organic acids and bases?
24. Explain the mechanism of E1 and E2 eliminations.
25. o-chloro toluene when treated with sodamide in liquid ammonia gives o-toluidine and m-toluidine. Explain this observation with relevant mechanism.
26. Explain Norrish I and Norrish II reactions.
27. Determine the R & S notations of the asymmetric carbon atoms in (+)-tartaric and (-) tartaric acid
28. Explain the conformational analysis of n-butane.
29. Give a brief account on optical activity due to restricted rotation.
30. Explain any two methods of determination of reaction mechanism.
31. What are non-benzenoid aromatics compounds. Explain their aromaticity with examples

(4 X 6 = 24marks) SECTION – D

(*Answer any2 question. Each question carries 15 marks*)

32. (a) Explain SN1 and SN2 mechanisms.
(b)Write the influence of structure of the substrate and polarity of the solvent on nucleophilic substitution reactions. (c) Explain Baeyer's strain theory.
33. (a) Explain the mechanism of (i) nitration (ii) halogenation of benzene.
(b) Discuss the orientation of influence of –NO_2 and –OH group in aromatic electrophilic Substitution.
(c) Discuss the classification of dyes on the basis of structure.
34. (a) What is resolution? Explain different methods of resolution.
(b) What are carbenes? How are they generated? Comment on the structure of carbene.
(c) Draw conformers of dimethyl cyclohexane and discuss their comparative stability.
35. (a) Write the synthesis and uses of the following dyes (i) Malachite green (ii) Methyl Orange.
(b) Explain the geometrical isomerism of maleic and fumaric acid.
(c) Explain the elimination-addition mechanism in halo benzens.

(15 X 2 = 30marks)

B.Sc. Chemistry Programme
Semester – V (Course V)
Course Code – CH1541 Credit - 3
Physical Chemistry – I 54 hours

Aim of the course: This course is an introduction to different states of matter and provides a firm foundation for understanding the physical principles that govern chemical systems. The course also describes the principles of chemical thermodynamics and group theory.

Objectives: Students, upon completion of this course, will gain exposure and practice in the areas of physical chemistry which include gas and liquid properties, thermodynamics, and group theory. The laws of thermodynamics form the appropriate organizational tool to understand the chemistry of bulk systems.

Module I – Gaseous state (9 hrs)

Ideal gas equation, Behaviour of real gases, Deviation from ideal behaviour, Compressibility factor, Boyle temperature - van der Waal's equation of state – derivation and importance, Virial equation of state.

Critical phenomena: Isotherms of CO_2, continuity of states, Critical constants and their experimental determination, relation between critical constants and van der Waals constants.

Types of molecular velocities and their inter relations. Maxwell Boltzmann distribution of molecular velocities, Statement of equation and explanation (No derivation), Effect of temperature on distribution of molecular velocities - Derivation of most probable and average velocities from the equation.

Collision properties. Collision diameter, Collision number, Collision frequency and mean free path. Relation between collision parameters and viscosity and thermal conductivity of gases (no derivation).

Module II – Solid state (9 hrs)

Isotropy and anisotropy, Space lattice and unit cell, Elements of symmetry of crystals, Bravais lattices, Crystal systems, Laws of rational indices, Miller indices, Representation of lattice planes of cubic crystals, Determination of Avogadro number from crystallographic data, X-ray diffraction studies of crystals, Bragg's equation – derivation and applications, Rotating crystal and powder method, Structure of NaCl and KCl Rutile, Zinc blend, Wurtzite - Imperfections in crystals, point defects – Schottky and Frenkel defects, Non-stoichiometric defects – Line defects – edge dislocation – screw dislocation.

Module III – Liquid state and Dilute solutions (9 hrs)

Vacancy theory of liquid state : Properties of liquids: Surface tension and its measurement by capillary rise and stalagmometer method, factors affecting Surface tension, Viscosity, Poisuelle's equation, Determination of viscosity by Ostwald's viscometer, Refractive index and its determination by Abbe refractometer.

Dilute solutions: Molarity, Molality, Normality and Mole fraction. Colligative properties, Thermodynamic derivation of $\Delta T_b = K_b \times m$ and $\Delta T_f = K_f \times m$, Osmotic pressure, van't Hoff equation and molecular mass, Isotonic solutions, Reverse osmosis - Determination of molecular mass of solutes by Beckmann's method, Rast's method and cooling curve method. Abnormal molecular mass, van't Hoff factor, Determination of degree of dissociation and association.

Module IV – Thermodynamics I (9hrs)

Types of Processes, Zeroth law of thermodynamics Definition of internal energy and enthalpy. Heat capacities at constant volume (Cv) and at constant pressure (Cp), relationship between Cp and Cv. Mathematical statement of first law. Reversible process and maximum work. Calculation of work, heat, internal energy change and enthalpy change fo r the expansion of an ideal gas under reversible isothermal and adiabatic condition. The Joule-Thomson effect – derivation of the expression for Joule-Thomson coefficient. Sign and magnitude of Joule-Thomson coefficient, inversion temperature.

Thermochemistry – standard states. Enthalpies of formation, combustion and neutralization. Integral and differential enthalpies of solution. Hess's law and its applications. Kirchoff's equation – Flame and explosion temperatures.

Module V – Thermodynamics II (9 hrs)

Need for II^{nd} law of thermodynamics. Different statements of II^{nd} law, Thermodynamic scale of temperature. Carnot cycle and its efficiency, Carnot theorem. Concept of entropy- Definition and physical significance. Entropy as a function of volume and temperature, Entropy as a function of pressure and temperature. Entropy as a criterion of spontaneity and equilibrium. Gibbs and Helmholtz free energies and their significances - criteria of equilibrium and spontaneity.

Gibbs-Helmholtz equation, dependence of Gibbs free energy changes on temperature, volume and pressure. Maxwell's relations. Partial molar quantities. Chemical potential-Gibbs-Duhem equation. Clapeyron – Clausius equation. Concept of fugacity, determination of fugacity by graphical method.

Module VI – Group theory – 9 hours

Group theory: Elements of symmetry – Proper and improper axis of symmetry, plane of symmetry, centre of symmetry and identity element. Combination of symmetry elements, Determination of point groups of simple molecules like Acetylene,H_2O, NH_3, BF_3, $[Ni(CN)_4]^{2-}$ and C_6H_6.Symmetry operations. Order of a group. Combination of symmetry operations. Group theoretical rules. Construction of Group multiplication table of C_2V. (5 hours)

Liquid crystals:

Origin of liquid crystals, mesogens self-organisation, Types –smectic, nematic and cholesteric liquid crystals, characterization of liquid crystals, Swarm theory of liquid crystals, uses of liquid crystals, characterization of LCmaterials by DSC, PLM and x-ray. (4 hours)

(At least 100 problems are to be worked out from all units together. 30% of the questions for Examination shall contain problems.) References

1. P W Atkins, "Physical Chemistry", Oxford University Press
2. R J Silby and R AAlberty, "Physical Chemistry", John Wiley & Sons
3. G W Castellan, "Physical Chemistry", Narosa Publishing House
4. F Daniels and R AAlberty, "Physical Chemistry", Wiley Eastern
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6. Puri, Sharma and Pathania, "Principles of Physical Chemistry", Millennium Edition, Vishal Publishing Co
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8. Gurdeep Raj, "Advanced Physical Chemistry", Goel Publishing House
9. S Glasstone, "Thermodynamics for Chemists", Affiliated East West Publishers
10. L V Azaroff, " Introduction to Solids", McGraw Hill
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12. Anthony R West, " Solid State Chemistry and its Applications", Wiley Eastern
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14. A. SalahuddinKunju and G. Krishnan "Group Theory and its Applications in Chemistry" 15. A.S.Negi and S.C.Anand, A text book of Physical Chemistry, New Age International publishers.

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
(2017 admissions onwards)

Semester V- Core Course-5 Course Code 1541 Credit-4
Physical Chemistry –I

Time: 3 Hrs Total marks: 80

Section A. Answer all the questions. Each question carries 1 mark

1. Write down the van der Waal's equation for n moles of a gas.
2. In which type of liquid crystals, the colour of the material is sensitive to temperature changes?
3. What are isotonic solutions?
4. Write down the conditions at which real gases tend to approach ideal behaviour.
5. Define the term fluidity.
6. What is inversion temperature?
7. Write down the efficiency of Carnot engine.
8. The average speed of a certain gas at 27^oC is $400ms^{-1.}$ Calculate the temperature at which the speed will be $800ms^{-1}$.
9. What is meant by unit cell in crystallography?
10. What is the physical significance of entropy? (1 x 10 = 10 marks)

Section B

Each question carries2 marks (Short answer). Answer any 8 questions

11. What are colligative properties?
12. Write the point group to which NH_3 belongs and mention the symmetry elements present in NH_3.
13. Explain van't Hoff factor
14. Explain first law of thermodynamics.
15. Derive the expression for Joule Thomson coefficient
16. Explain any two statements of second law of thermodynamics.
17. Maximum work is obtained from a reversible process. Substantiate.
18. What are the proper and improper axes of symmetry?
19. Draw the group multiplication table of C_{2v}point group 20.Define the terms collision frequency and collision number.
21. Explain virial equation of state.
22. Explain elements of symmetry of crystals. (2×8 = 16)

Section C

Each question carry 4 marks (Short essay) Answer any 6 questions

23. Derive root most probable velocity and average velocity from Maxwell- Boltzmann equation.
24. An aqueous solution containing 0.25 g of a solute dissolved in 20 g of water froze at – 0.42 ^oC. Calculate the molar mass of the solute. Molar heat of fusion of ice at 0^oC is 6.025 KJ and R = 8.314 $JK^{-1}mol^{-1}$
25. Deduce the relationship between Cp and Cv by thermodynamics.
26. Explain different types of semi-conductors and their uses.
27. What is the law of corresponding states? How is it derived from van der Waals equation.
28. Explain Gibbs - Helmholtz equation and its significance
29. What is chemical potential and derive Gibbs Duhem equation?

30. Explain Hess's law and its applications
31. Derive the relation between depression of freezing point and lowering of lowering of vapour pressure.

(4 x 6 = 24 marks)

Section D

Each question carries 15 marks (essay), Answer any two questions

32. a) Derive Bragg's equation. (5 marks)

b) The edge length of the unit cell of NaCl crystal lattice is 564 pm by X-ray diffraction. Compute the interionic distance between sodium and chloride ions. (5 marks)

c)Explain point defects in a crystal. (5 marks)

33. a) What is meant by reversible process? Derive an expression for work done in the reversible isothermal expansion of an ideal gas. (5 marks) b) Calculate the work done in expanding one mole of an ideal gas from a volume of 2 to 20 dm^3 at 27 ^0C (5 marks) c) Derive the relation between Cp and Cv. (5 marks)

34. a) Calculate Tc, Pc and Vc for C2H2. Given a = 4.390 atm litre mol^{-2}, b=0.05136 litre mol^{-1}. (5 marks)

b) Do all gases obey gas laws? Discuss some experimental results to explain deviation and point out the causes which accounts for this behaviour. (10 marks)

35. a) Derive thermodynamically the relation between the elevation of boiling point of a solvent and molal concentration of an electrolyte dissolved in the solvent. (5 marks) b) The surface tension of water at 293 K is 72.75 dyne cm^{-1}. How high will a column of water rise in a capillary tube with a radius of 0.005 cm. (5 marks) c) Illustrate the operation improper rotation. (5 marks)

(15x2=30)

B.Sc. Chemistry Programme

Semester 5 Course – V Course Code –CH1542 Credit 4

Inorganic Chemistry – III (72 hrs)

Lecture-Tutorial-Lab: 4-0-3 hours per week; eighteen 5-day weeks per semester. Contact hours per semester: 72 hrs lecture and 54 hrs related lab instruction.

Aim of the course: The main objective of this course is to help students to learn the important multidisciplinary areas of bioinorganic chemistry and organometallic chemistry. The main theme of this course is the importance of fundamental concepts needed to understand transition metal chemistry, including transition meta l ions in biological systems and about the inner transition elements and the principles of coordination chemistry. The course also describes about the general principles of isolation and purification of elements and instrumental methods of analysis.

Objectives: Students, upon completion of this course, will gain exposure and practice in the areas of inorganic chemistry which include coordination chemistry, transition and inner transition elements. Students will have a thorough understanding of the classification of several organometallic reactions and will be able to identify the role of organometallic compounds in organic synthesis. Instrumental methods of analysis and general principles of isolation of elements help the students to understand about the experimental techniques used in chemistry and how the elements are isolated from their ores.

Course out line

Module I Transition and inner transition elements *(18 hrs)*

(a) Transition elements : Electronic configuration and general characteristics – oxidation state, ionization enthalpy (variation of I,II and III ionization enthalpy across 3d series), enthalpy of atomisation, melting and boiling point, density, variation of std. electrode potentials ($E^o_{M^{2+}/M}$& $E^o_{M^{3+}/M^{2+}}$), stability of higher oxidation states, colour, magnetic property, catalytic property and formation of complexes. Comparison of 3d, 4d and 5d transition series –Preparation, properties and uses of $K_2Cr_2O_7$, $KMnO_4$ and $TiCl_4$. Important application of transition metals

(b) Lanthanides and actinides : Lanthanides - electronic configuration and general properties, reactions – Occurrence and isolation of lanthanides from monazite – Lanthanide contraction – consequences of lanthanide contraction– Magnetic properties and complexation behaviour.

Actinides – Oxidation states, ionic radii, colour, complex formation, actinide contraction, comparison with lanthanides.

Module II Coordination Chemistry *(18 hrs)*

Nomenclature (latest version) – ligands and their classifications. EAN rule – Chelates – Stability of complexes – Factors affecting stability of complexes – Isomerism – Structural and stereoisomerism – Geometrical and optical isomerism – Bonding in complexes – V.B. Theory, CFT applied to Oh, Td and SPcomplexes. factors affecting crystal field, –– Spectrochemical series – CFSE, Magnetic properties and colour of metal complexes .Effect of crystal field splitting –Jahn -Teller effect, Tetragonal distortion of an octahedral complex- –– Application of coordination compounds in quantitative and qualitative analysis. Reactions of metal complexes-labile &inert complexes, ligand substitution reactions- S_N1 & S_N2 reactions-

Module III Organometallic Compounds(12hrs)

Organometallic Compounds : Definition – Nomenclature and classification – sigma complex – Pi complex – those containing both sigma and Pi bonds – 18 electron rule – Metal carbonyls – mononuclear and polynuclear (give examples of carbonyls of Fe, Co, Ni) – preparation and properties of carbonyls(Fe, Ni, Mn, Cr) Vibrational frequency of CO bond in metal carbonyls – Bonding in organometallic compounds like ferrocene, dibenzene chromium, Ziese's salt (Without MOT)– Dinitrogen complexes – Application of organometallic compounds.

Module IV Bioinorganic Chemistry 6 hrs

Bioinorganic Chemistry: Role of metal ions in biological systems – Biochemistry of iron, haemoglobin and myoglobin (elementary idea of the structure and mechanisms of their actions). Electron transport proteins: Cytochromes, Fe- Sulphur proteins, Storage and transport of iron .Photosynthesis – Sodium-Potassium pump - Biochemistry of magnesium and calcium (brief study only)

Module V General Principles of Isolation of Elements 9hrs

Methods of concentration of an ore-Gravity separation, Froth floatation, Magnetic separation, Leaching, electrostatic separation, Automated ore sorting and dewatering,Preliminary processes - calcination and roasting.

Methods of preparing metal from concentrated ore- Electro metallurgy- Metallurgy of Aluminium, Sodium-Pyro Metallurgy- - Metallurgy of Iron, Zinc, Aluminothermy, Auto reduction-Hydro Metallurgy- Metallurgy of Silver, Gold

Purification of crude metal- Distillaion, Liquation , Zone refining, Vapour phase refining (Mondsproess and van Arkel processes), Electro refining, Chromatography technique

Module VI: Instrumental Methods of Analysis 9hrs

Atomic absorption spectroscopy- flame emission spectroscopy- applications – colorimetry- spectrophotometry- laws of spectrophotometry- Beer- Lambert's law- applications of spectrophotometry- thermal methods- introduction to TG, DTA and DSC- instrumentations and applications. Tools for measuring nanostructures: XRD, Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy(STM), Scanning Electron Microscopy(SEM), Transmission Electron Microscopy(TEM) *References:*

1. Advanced Inorganic Chemistry : Cotton and Wilkinson
2. Inorganic Chemistry : J.E. Huheey
3. Inorganic Chemistry : Shriver and Atkins
4. Concise inorganic Chemistry :J.D.Lee
5. Coordination Chemistry :Bosolo and Johnson
6. Coordination Chemistry : S. F. A. Kettle
7. Bio inorganic Chemistry : M.N. Hughes
8. "Fundamentals of Inorganic Chemistry" : E. S. Gilreath
9. "Instrumental Methods of Analysis" : Willard, Merrit
10. A. K. Srivasthava and P. C. Jain, "Chemical Analysis"
11. Puri, Sharma and Kalia "Inorganic Chemistry"

University of Kerala

Model Question Paper of B.Sc. Chemistry Programme

2017 admissions onwards

Semester V Course VI Course Code CH1542 Credit-4

Inorganic Chemistry III

Time: Three Hours Maximum Marks : 80

Section A

Answer all questions, each question carries 1 mark (answer in a word\sentence)

1. Which is more basic; $La(OH)_3$or $Lu(OH)_3$?
2. Give the general outer electronic configuration of a transition element.
3. Which is the catalyst used in the oxidation of SO2 to SO3 in contact process?
4. Name the element obtained by the bombardment of ^{238}U with an a – particle.
5. What is the coordination number of Ag in $[Ag(CN)_2]$?
6. Give the IUPAC name of $Na_3[Co(CO_3)_3]$ 7 What is the unit of magnetic moment?
8. Give the example for a tridentate ligand.
9. Write the structure of ferrocene.
10. Give the formula of a metal carbonyl which does not obey 18-electron rule. (1 x 10 = 10)

Section B

Answer any 8 questions, each question carries 2 marks (short answer questions)

11.Explain zone refining.

12.Name the metal ion, other than magnesium, involved in photosynthesis.

13. Give an example of phosphorus based polymer.

14. What is ‘inorganic graphite?

15. What is the oxidation number of P in H3PO4?

16. Give the formula of a methanide.

17. Transition metals are less reactive than the alkali and alkaline earth metals - Justify.

18. Which is more stable: Cu^{2+} or Cu^{+}in aqueous solution. ? Substantiate your answer.

19. Which has got greater tendency to form complexes; lanthanides or actinides ? Give reasons. 20.Write the difference between calcinations and roasting 21.What is an ambidentateligand ? Give example.

22.Explain geometrical isomerism in metal complexes with suitable example.

(2x8=16)

Section C

Answer any 6 questions, each question carries 4 marks (short essay type)

23.What is Ziese’ssalt ? Give its structure.

24. State and explain 18-electron rule.

25. How haemoglobin differ from myoglobin.

26. What are carboranes ?

27. Purification of crude metals by Mondsproess and van Arkel processes

28. What happens when orthophosphoric acid is heated ?

29. What is lanthanide contraction ? Explain its consequences .

30. What are the factors that affect stability of metal complexes ?31.Give an account of the applications of coordination compounds in quantitative and qualitative analysis.

Section D

(Answer any 2 questions, Each question carries 15 marks) (essay type)

32.a.Describe the ion exchange method for the separation of lanthanides from monazite. (5 marks)

b. Describe the splitting of d-orbitals in tetrahedral and octahedral fields according to crystal field theory.(5 marks)

c.Comment on the magnetic properties of lanthanides .(5 marks)

33.a.Give an account of the preparation, properties, structure and bonding of noble gas compounds. (10 marks)

b.Discuss the nature of bonding in metal carbonyls. (5marks)

34.a.How silicones are prepared ? Discuss their structure and uses.

b.Give an account of sodium-potassium pump in biological systems.

c.Explain the principle of TG with example.

35.a.Starting from pyrolusite, how KMnO4 is prepared ?

b.Explain the principle and working of AFM.

Semester- V Core Course -VII Credit-4 Course Code – CH1543

Organic Chemistry- II

72 Hrs Lecture- Tutorial- Lab : 4-0-2

Aim of the Course: The course deals with organic compounds like alcohols, aldehydes, ketones, ethers, acids and their properties. The course also describes the principles of spectroscopy and spectral applications to organic molecules and also introduces the fundamentals of green chemistry and supramolecular chemistry.
Objective of the Course: The students will get an interesting idea about the preparation and properties, mechanism of reactions of many organic conversions and of organic compounds. They will also get sufficient knowledge to interpret spectrum of organic compounds and the novel areas of organic chemistry – the supramolecular and green chemistry.

Organic chemistry Paper II

Module I: Alcohols, Phenols and Ethers (12 hours)

Alcohols: Preparation: From alkenes (hydration. Hydroboration-oxidation, oxy-mercurationdemercuaration) and carbonyl compounds (reduction and with Grignard reagent)

Chemical properties: Reactions involving cleavage of O-H bonds (acidity and esterification), oxidation (with PCC, Collins reagent, Jones reagent and $K_2Cr_2O_7$) and catalytic dehydrogenation – distinction between primary, secondary and tertiary alcohols – Ascent and descent in alcohol series. Biofuel – ethanol and biodiesel.

Dihydric alcohols: Oxidative cleavage – Lead tetra acetate, periodic acid – Pinacol-pinacolone rearrangement.

Phenols: Preparation from halobenzens, cumene and sulphonic acid. Chemical properties: Acidity of phenol - effect of substituents on acidity. Comparison of acidity with alcohol – bromination, nitration, sulphonation, Reimer-Tiemann reaction (mechanism expected), Kolbe reaction, Liebermann's nitroso reaction and Lederer-Mannasse reaction. Distinction between alcohols and phenols.

Ethers: Preparation by Williamson's synthesis. Reactions of ethers : Cleavage by HI and Claisen rearrangement (Mechanism expected) – Ziesel's method of estimation of methoxy group. Crown ethers: Nomenclature and importance of crown ethers.

Epoxides: Preparation from alkenes – acid and base catalysed ring opening reactions.

Module II : Aldehydes and Ketones (12 hours)

Preparation: Oxidation of primary and secondary alcohols using PCC, reduction of esters using DIBAL-H, Rosenmund reduction, Gattermann-Koch formylation and Friedel-Craft's acylation.

Chemical properties: Nucleophilic addition (HCN, $NaHSO_3$, RMgX and ROH)
Addition-elimination reaction (with ammonia and ammonia derivatives)
Reduction (Metal hydrides (mechanism expected), MPV reduction, Clemmenson and Wolff-Kishner reduction)

Oxidation: with $KMnO_4$, Tollen's reagent, Fehling solution, Br_2 water, Oppenaur oxidation, Baeyer-Villiger oxidation.
Acidity of α-hydrogen: Aldol, Claisen-Schmidt, Benzoin, Perkin and Knovenagel condensations (Mechanisms expected).
Haloform reaction – Iodoform test – Cannizaroreaction(mechanism expected) and Beckmann rearrangement(mechanism expected)

Module III: Carboxylic acids, Sulphonic acid and their Derivatives (12 hours)

Preparation: Hydrolysis of nitrile, carboxylation of Grignard reagent and oxidation of alkyl benzenes.

Chemical properties: Acidity – effect of substituents on the acidity of aliphatic and aromatic carboxylic acids – HVZ reaction – Decarboxylation – Kolbe electrolysis (Mechanism expected). Ascent and descent series in aliphatic carboxylic acids.

Preparation, properties and uses of anthranilic acid, cinnamic acid, citric acid, lactic acid, oxalic acid, adipic acid and phthalic acid.

Formation of acid derivatives – acid chlorides, amides, acid anhydrides and esters – comparison of reactivity of acid derivatives. Preparation of coumarin – Fries rearrangement (Mechanism expected)

Preparation and reactions of benzene sulphonic acid, toluene sulphonic acid and benzene sulphonyl chloride – Importance of tosyl group – synthesis and application of saccharin.

Module IV: Organic Nitrogen Compounds (12hours)

Nitrocompounds: Nitro-acitautomerism – Nef's reaction – reduction of nitrobenzene in various media – nitro compounds as explosives.

Amines: Classification – Preparation: From alkyl halides, nitro compounds, nitriles, isonitriles and amides – Hoffmann's bromamide reaction, Schmidt reaction, Gabriel phthalimide synthesis.

Chemical properties: Basicity (effect of substituents on the basicity of aliphatic and aromatic amines), Carbyl amine reaction, conversiton of amines to alkene (Hoffmann elimination with mechanism), acylation and reaction with nitrous acid. Electrophilic substitution reactions of aniline: halogenation, nitration and sulphonation. Benzidine rearrangement (mechanism expected).
Separation of mixture of amines – methods to distinguish primary, secondary and tertiary amines.

Preparation and synthetic applications of diazonium chloride and diazomethane.

Module V: Organic Spectroscopy I (12 hours)

UV – Visible spectroscopy – types of electronic transitions, effect of conjugation, concept of chromophore, auxochrome, bathochromic, hypochromic shifts, hyperchromic and hypochromic effects. UV-Visible spectra of enes. Calculation of λ_{max} of dienes and α,β-unsaturated ketones.

IR spectroscopy – Molecular vibrations - Functional group and finger print region – group frequencies – effect of hydrogen bonding on –OH stretching frequency – factors influencing carbonyl stretching frequency. Comparison of carbonyl stretching frequency in compounds containing carbonyl group.

Interpretation of IR spectra of simple organic molecules such as salicylaldehyde, benzamide, acetophenone, nitro benzoic acid and phenyl acetate.

Theory of Mass spectrometry – mass spectrum, base peak and molecular ion peak, types of fragmentation, McLafferty rearrangement, isotopic effect.

Module VI Organic Spectroscopy II (6 hours)

NMR spectroscopy – principle of proton NMR – shielding and deshielding effect, chemical shift, factors influencing chemical shift, spin-spin splitting, coupling constant, interpretation of PMR spectrum of simple molecules like $CHBr_2CH_2Br$, ethylbromide, pure ethanol and impure ethanol (acidic impurities) acetaldehyde and toluene. Structural elucidation of simple organic molecules using IR and NMR spectroscopic techniques.

Module VII: New Frontiers in Organic Chemistry (6 hours)

Supramolecular chemistry : Introduction – molecular recognition – host-guest interactions – types of non-covalent interactions .

Green chemistry : Introduction – atom economy – principles of greenchemistry.

Newer methods of synthesis : Ultrasound, microwaves and phase transfer catalysis. References

(1) A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand& Company, New Delhi.
(2) L.G.Wade Jr, Organic Chemistry, Pearson Education, New Delhi.
(3) K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
(4) S.C.Sharma and M.K.Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi..
(5) P.L.Soni, Organic Chemistry
(6) I L Finar, "Organic Chemistry" Vol – 1, 5th Edition, Pearson Education, New Delhi.
(7) R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
(8) P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
(9) J.Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
(10) G.M. Louden, Organic Chemistry, Oxford University Press, New York.
(11) V.K.Ahluwaliya, Organic Reaction Mechanisms, Narosa Publishing House, New Delhi.
(12). Y.R.Sharma, Elementary Organic Spectroscopy, Pearson Education, New Delhi
(13) R.M.Silverstein and F.X.Webster, Spectrometric Identification of Organic Compounds, John Wiely and Sons, New York.
(14) P.S.Kalsi, Application of Spectroscopic Techniques in Organic Chemistry, New Age International, New Delhi.
(15) William Kemp, Organic Spectroscopy, Macmillan, New York.

(16) D.L.Pavia, G.M.Lampman and G.S.Kriz, Introduction to Spectroscopy, Thomson Brooks Cole.
(17) Helena Dodzuik, Introduction to supramolecular chemistry, Springer.
(18) L.M. Lehn, Supramolecular Chemistry, VCH.
(19) M.M.Sreevastava and Rashmi Sanghi, Green Chemistry for environment, Narosa Publishing House.
(20) V.K.Ahluwalia, Green Chemistry, Enviornmentally Benign Reaction, Ane Book Pvt. Ltd.

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER V Core Course VII Credit 4 Course Code CH1543
ORGANIC CHEMISTRY II

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. What is Williamson's synthesis?
2. Which reagent is used for the oxidative cleavage of 1,2-diols?
3. Give a test to distinguish aliphatic aldehydes from aromatic aldehydes.
4. What is atom economy.
5. What is HVZ reaction?
6. What happens when aniline is treated with bromine?
7. Identify the types of electronic transitions in CH_3CHO.
8. What is base peak?.
9. What is PTC?
10. Write the frequency range useful for the identification of organic compounds.

(10 X 1 =10 Marks)

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. Why phenol is more acidic than methanol?
12. How can you convert isopropanol to tert.butyl alcohol?
13. What is iodoform test?
14. What is MPV reduction?
15. How coumarin is prepared?
16. How will you convert acetic acid to propionic acid?
17. Explain Nef's reaction.
18. Write the mechanism of Benzidine rearrangement?
19. What is finger print region? Give its importance.
20. Differentiate bathochromic and hypochromic shifts.
21. What is TMS? Why it is selected as a reference compound in H-nmr spectroscopy?
22. What is DIBAL? What is its use?

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. Explain Zeisels method of estimating methoxy group?
24. How can you distinguish primary, secondary and tertiary alcohol?
25. Write the importance of LiAlH4 and NaBH4 in carbonyl chemistry.
26. Comment on Clemmensen and Wolff-Kishner reduction.
27. How cinnamic acid is prepared? Explain its important properties.
28. Discuss Hoffmann elimination?
29. Explain microwave synthesis with examples.
30. (i) How can you distinguish inter and intra molecular hydrogen bonding using IR spectroscopy?
    (ii) Predict the regions where salicylaldehyde give IR absoptions.
31. Explain spin-spin coupling with an example.

(6 X 4 = 24marks)

SECTION – D

(*Answer any2 question. Each question carries 15 marks*) 32. (a) Write the mechanism of the following reactions:(a)Aldol condensation and (b) Benzoin Condensation.

(b) Discuss the mechanism of (i) Reimer-Tiemann reaction and (ii) Claisen Condensation.

(c) Comment on the following (i) Biodiesel and (ii) Crown ethers.

33. (a) Explain the synthesis and applications of saccharin.

(b) How diazonium chloride is prepared? How is it useful to synthesis the following compounds phenol, iodobenzene, azocompounds,

(c) How can you effect the following conversions (i) aniline to para-bromo aniline (ii) Benzamide to aniline.

34. (a) Discuss the Woodward-Fieser for calculating λ_{max} of dienes.

(b) Explain the principle of nmr spectroscopy.

(c) A compound with molecular formula C_8H_8O shows the following absorptions:

(i) IR Spectrum: 3050, 2950, 1700, 1620, 1550, 690 cm^{-1}.

(ii) pmr spectrum: δ 7-8ppm (multiplet, 5H), 2.5ppm (singlet, 3H).

Identify the structure of the compounds.

35. (a) How primary, secondary and tertiary amines are separated?

(b) Discuss the preparation and important reactions of benzene sulphonic acid.

(c) Discuss the different types of non covalent interactions in molecules.

(15 X 2 = 30marks)

B.Sc. Chemistry Programme

Semester – VI Course VIII Course Code – CH1641 Credit-4 Physical Chemistry – II Total: 72 hours

Aim of the course: To learn statistical mechanics which explains the chemical and physical properties and dynamics in the thermodynamic limit from a knowledge of the microscopic properties of the constituent atoms and molecules of a bulk system. The concepts of quantum mechanics and spectroscopy which provide a complete description of chemistry at the microscopic level, form the basis for the course.

Objectives: Students will explain and apply the concepts of thermodynamics, quantum mechanics, and spectroscopy to chemical, physical, and biochemical systems. Students will be able to derive essential mathematical relationships in thermodynamics, quantum mechanics, and spectroscopy. Students will evaluate physical and chemical systems by non spectroscopic techniques.

Module I – Thermodynamics III & Statistical thermodynamics 12 hrs

Nernst heat theorem, proof and its consequences. Statement of IIIrdlaw-Plank's statement, Lewis Randall statement. Concept of perfect crystal, evaluation of absolute entropies of solid, liquid and gas. Exception to IIIrd law with reference to examples- CO, NO, N_2O and H_2O Phase space, system, assembly and ensemble-types of ensembles and uses. Thermodynamic probability, Boltzmann distribution law (no derivation). Partition function, entropy and probability. Thermodynamic functions in terms of partition functions - internal energy, enthalpy, pressure, work function and free energy function.

Module II – Colloids and Adsorption 12 hrs

Colloidal state: Classification of colloids, Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule, Gold number. Gels: Elastic and non-elastic gels, Imbibition and syneresis, Micelles and critical micelle concentration, sedimentation and streaming potential, Application of colloids – Cottrell precipitator, purification of water and delta formation.

Adsorption: Physical and chemical adsorption, Freundlich adsorption isotherm, Derivation of Langmuir adsorption isotherm, Statement and explanation of BET and Gibbs isotherms, determination of surface area of adsorbents by BET equation. Applications of adsorption.

Module III – Quantum mechanics - 12 hrs

Radiation phenomena- blackbody radiation, photoelectric effect, Compton effect and atomic spectra. Plank's quantum theory and explanation of the radiation phenomena. Schrodinger wave equation – significance of Ψ, well behaved functions, Concept of operators and some operators of interest (properties of operators not required), Postulates of quantum mechanics Application of quantum mechanics to simple systems - particle in 1 D box, normalization of wave function, Particle in 3 D box. Concept of degeneracy. Application to hydrogen atom (no derivation) Schrodinger wave equation in Cartesian and spherical polar co-ordinates, Quantum numbers.

Module IV – Spectroscopy – 12 hrs

Regions of electromagnetic spectrum. Different units of energy (erg, joule, calorie, cm^{-1}, Hz, A^0 and eV) and their inter conversions. Interaction of radiations with matter. Various types of molecular spectra. Born-Oppenheimer approximation.

Rotational spectroscopy: microwave spectra of diatomic molecules, energy expression, selection rule, rotational energy levels, determination of bond length.

Vibrational spectroscopy: Harmonic oscillator. IR spectra of diatomic molecules. Energy expression. Selection rules, frequency of separation, calculation of force constant, anharmonic oscillators. Morse equation. Fundamental and overtone transitions, combination bands, degree of freedom of polyatomic molecules.

Raman spectroscopy: Stoke's and antistoke's lines and their intensity difference, rotational Raman spectrum. Selection rule. Frequency of separation, vibrational Raman spectrum, Mutual exclusion principle.

Module V – Spectroscopy – II 12 hrs

Electronic spectroscopy: Frank-Condon principle. Singlet and triplet states. Electronic spectra and diatomic molecules. Dissociation energy, electronic spectra of polyatomic molecules (qualitative idea only).

NMR spectroscopy: Principle of NMR, nuclear spin. Interaction of nuclear spin with external magnet. Precession. Relaxation, Chemical shift. Low resolution spectra. Delta and tau scales. Spin-spin coupling and high resolution spectra, application of NMR in MRI.

Electron spin resonance spectroscopy: principle. Types of substances with unpaired electrons, interaction of electron magnet with external magnet. Energy level spliting. Lande splitting factor, presentation of ESR spectrum. The normal and derivative spectra. Hyperfine splitting. Simple examples like methyl and benzene radicals.

Introduction to Mossbauer Spectroscopy

Module VI – Non-spectroscopic methods 12 hrs

Non-spectroscopic methods: Dipole moment, Debye equation and Clausius-Mosotti equation, measurement of dipole moment by temperature method, Dipole moment and molecular structure, Diamagnetism and paramagnetism, Magnetic susceptibility and unpaired electrons, measurement of magnetic susceptibility, Molar refraction and molecular structure, Atomic refraction, Optical exaltation, Parachor and atomic equivalent of para chor.

(At least 100 problems are to be worked out from all units together. 30% of the questions for Examination shall contain problems.)

References

1. P W Atkins, “Physical Chemistry”, Oxford University Press
2. R J Silby and R AAlberty, “Physical Chemistry”, John Wiley & Sons
3. G W Castllan, “Physical Chemistry”, Narosa Publishing House
4. Puri, Sharma and Pathania, “Principles of Physical Chemistry”, Millennium Edition, Vishal Publishing Co.
5. Gurdeep Raj, “Advanced Physical Chemistry”, Goel Publishing House.
6. S Glasstone, “Thermodynamics for Chemists”, Affiliated East West Publishers
7. M C Guptha, “Elements of Statistical Thermodynamics”, New Age International (P) Ltd.
8. L K Nash, “Elements of Statistical Thermodynamics”, Addison Wesley
9. A W Adamson, “The Physics and Chemistry of Surfaces”, Interscience
10. N K Adam, “ The Physics and Chemistry of Surfaces”, Oxford University Press
11. M W Hanna, “Quantum Mechanics in Chemistry”, Benjamin
12. I N Levine, “Quantum Chemistry”, Prentice Hall
13. C N Banwell, “Fundamentals of Molecular Spectroscopy”, Tata McGraw Hill
14. Manas Chanda, “ Atomic structure and Chemical bonding in Molecular Spectroscopy”, Tata McGraw Hill
15. Physical Chemistry, R. Stephen Berry, Stuart A Rice & John Rose 2nd Edn Oxford 16. A.S.Negi and S.C.Anand, A text book of Physical Chemistry, New Age International publishers.

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2017 admission onwards
Semester VI Core Course-VIII Course Code CH1641 Credit-4
Physical Chemistry II

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

1. Which of the following will give pure rotational spectrum? H_2, N_2, CO_2, HCl.
2. Write the mathematical definition of Laplacian operator.
3. Which branch of spectroscopy is used for the identification of free radicals?
4. What is the significance of polarizability of a molecule?
5. What is responsible for the stability of a lyophilic sol?
6. State The Heisenberg uncertainty principle.
7. Give the expression for Freundlich adsorption isotherm.

8. Give the expansion of STM.
9. Give the selection rule for rotational spectroscopy.
10. What is the unit of dipole moment?

Section B,

(2 marks each), [Short answer]. Answer any 8 questions

11. What is meant by Critical Micelle Concentration (CMC)?
12. What is sedimentation?
13. What is the significance of wave function of a particle?
14. Give any two applications of ESR spectroscopy.
15. What do you mean by the term 'parachor'?
16. What is meant by normal modes of vibrations?
17. What is zeta potential ?
18. Calculate the number of fundamental modes of vibrations of CO2 and SO2 molecules.
19. How does stokes and anti stokes lines originate in Raman spectrum.
20. Explain chemical shift.
21. Explain blackbody radiation
22. What is hyperfine splitting in esr?

Section C

Each question carries 4 marks(Short essay), Answer any 6 questions

23. What is an ensemble, explain the different types of ensembles.
24. Discuss the postulates of quantum mechanics.
25. Explain the underlying principle of NMR spectroscopy.
26. What is meant by Optical Exaltation? Calculate the optical exaltation of2,6-dimethylhepta-2,5-dien-4-one.
27. Compare physisorption and chemisorptions
28. What are the consequences of unharmonicity in vibrational spectroscopy?
29. What is Debye equation ? Explain its significance.
30. Explain mutual exclusion rule with examples.
31. The fundamental vibrational frequency of carbon monoxide molecule is 2170. cm^{-1} Calculate the force constant of the molecule.

Section D,

15 marks each (Long essay) Answer any two question

32. a) Derive and explain Langmuir adsorption isotherm. (5 marksx3 = 15)
    b) What is meant by partition functions? Derive expressions for internal energy and enthalpy.
    c)The acceptable solutions to Schrodinger wave equation must have some special properties. What are these? Elaborate.
33. a) What is Hardy-Schulze rule and what are the principles involved in the mechanism of coagulation? (5 marksx3 = 15)
    b) Show that for a rigid diatomic rotor, the moment of inertia is given by $I = \mu r^2$
    c)The pure rotational spectrum of a gaseous molecule CN consists of a series of equally spaced lines

separated by 3.7978cm^{-1}. Calculate the internuclear distance of the molecule. The molar masses are; ^{12}C=12.011 and^{14}N=14.007 g mol^{-1}.

34. a) How can NMR spectrum distinguish between the isomers: p-xylene and ethyl benzene?

(5 marks x3 = 15)

b) Explain the shielding and deshielding mechanism in NMR.

c)Give the hyperfine structure of ESR spectrum of hydrogen atom.Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33T. Given g_e = 2 and μ_B = 9.273x10-24 JT^{-1}.

35. a) Discuss the function of a protective colloid. (5 marks x3 = 15)

b) What is meant by electrodialysis?

c)Explain BET theory.

B.Sc. Chemistry Programme

SEMESTER VI Core Course IX Credit – 4 Course Code CH1642

Organic Chemistry Paper – IIITotal
: 54 hours

Lecture - Tutorial – Lab: 3-0-2

Aim of the Course:

The syllabus deals with organic compounds carbohydrates, amino acids, proteins, nucleic acids, oils, fats, detergents, vitamins, terpenes, alkaloids, and polymers and their properties

Objective of the Course: The students will get an interesting idea about the preparation and properties mechanism of reactions of many organic conversions and of organic compound.

Module I: Carbohydrates

Classification and nomenclature of monosaccharides, configuration of monosaccharides. Reactions of glucose and fructose – structure of glucose and fructose – anomers and mutarotation (mechanism expected) - cyclic structure – pyranose and furanose forms – determination of ring size – Haworth projection formula – chair conformations.

Epimers and epimerization – Interconversion of aldoses and ketoses – chain lengthening and shortening of aldoses.

Disaccharides – reactions and structure of sucrose (structural elucidation not required)

Polysaccharides – Structure of starch and cellulose (structural elucidation not required) – Industrial applications of cellulose.

Module II: Heterocyclic compounds and Drugs (9 hours)

Heterocyclic compounds – classification – nomenclature – aromaticity.

Preparation (special reference to Paal-Knorsyntheisis and Hantzsch synthesis) and properties of furan, pyrrole, thiophene and pyridine. Basicity of pyridine and pyrrole.

Synthesis and reactions of quinoline, isoquinoline and indole with special reference to Skraup, Bischler-Napieralski and Fischer-Indole synthesis. Structural elucidation of quinoline.

Structure of purine and pyrimidine bases.

Chemotherapy – Drugs – introduction – classification – Synthesis of sulphanilamide, sulphathiazole and sulphapyridine. mode of action of sulphadrugs and amphicillin.. Elementary idea of the structure and application of chloroquine, paracetamol and aspirin.

Module III: Amino acids, proteins and nucleic acids (9hours)

Amino acids – classification, structure and stereochemistry of amino acids, essential and non essential amino acids – zwitter ion, isoelectric point.
Synthesis of amino acids – Strecker synthesis, amidomalonate synthesis, Erlenmeyer azlactone synthesis.

Peptides: Structure and synthesis (Carbobenzoxy, Sheehan and solid phase synthesis)

Proteins – classification of proteins –structure of proteins –denaturation and colour reactions.

Nucleic acids: Classification and structure of DNA and RNA. Replication of DNA. Transcription and Translation - Genetic code.

Module IV: Natural products (9 hours)

Terpenes – Classification - Isoprene rule - Essential oil – Source, structure, (no structural elucidation) and uses of citral and geraniol, limonene and menthol. Structure of natural rubber – vulcanization and its advantages.

Alkaloids – Extraction and structural elucidation of conine and nicotine. Importance of quinine, morphine and codeine.

Vitamins : Classification, structure, functions and deficiency diseases (structure of vitamin A, B1 and C only - but no structural elucidation).

Lipids – biological functions – oils and fats – common fatty acids – hydrogenation – rancidity - saponification value, iodine value, acid value.

Module V: Soaps, Detergents and Polymers (9 hours)

Soaps and detergents: Soap – synthetic detergents – cleaning action of soap and detergents.

Polymers: General idea of monomers, polymers and polymerisation – Degree of polymerisation – polydispersity - number and weight average molecular mass.

Classification of polymers, Homopolymers and copolymers, Addition and condensation polymers, thermoplatstics and thermosets – mechanism of addition polymerization (Cationic, anionic and free radical) – Tacticity – role of ZieglerNatta catalyst in directing the tacticity in polypropylene (mechanism not required).

Addition polymerisation. Preparation and uses of (i) polyethylene (ii) PVC (iii) Teflon
Condensation polymerisation:(i) phenol-formaldehyde resin (ii) epoxy resin (iii)nylon-66
(iv) polyethylene terephthalate. Synthetic rubbers – SBR and nitrile rubbers. Biodegradable polymers Additives to polymers – Plasticisers, stabilizers and fillers

Module VI: Organometallics, Active methylene compounds and Reagents in Organic synthesis.(9 hours)

Organomagnesium compounds: Grignard reagent: Preparation – Reaction with compounds containing acidic hydrogen, carbonyl compounds, cyanides and CO_2.

Organo lithium compounds: Preparation – Reaction with compounds containing acidic hydrogen, alkyl halides, carbonyl compounds, cyanides and CO_2.

Organo zinc compounds: Preparation of dialkyl zinc – Reaction with active hydrogen compounds, acid halides and alkyl halides – Reformatsky reaction (mechanism expected)

Li dialkylcuprates – Preparation and reaction with aliphatic/aromatic/vinyl halides.

Active methylene compounds – examples – Preparation of ethyl acetoacetate by Claisen condensation (mechanism expected) – tautomerism – Synthetic applications of acetoacetic ester.

Reagents in organic synthesis: Study of the following reagents with respect to functional group transformations –

(1) $LiAlH_4$ – reduction of =CO, -COOR and –$CONH_2$.
(2) $NaBH_4$ andDiborane – reduction of =CO
(3) SeO_2 - hydroxylation of allylic and benzylic positions, oxidation of CH_2 alpha to =CO to =CO
(4) NBS : Allylic and benzylic bromination.

References:

(1) A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand& Company, New Delhi.
(2) L.G.Wade Jr, Organic Chemistry, Pearson Education, New Delhi.
(3) K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
(4) S.C.Sharma and M.K.Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi..
(5) P.L.Soni, Organic Chemistry.
(6) I L Finar, "Organic Chemistry" Vol – 1&2, 5th Edition, Pearson Education, New Delhi.
(7) R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
(8) P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
(9) J.Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
(10) G.M. Louden, Organic Chemistry, Oxford University Press, New York.
(11) Gowariker V.R., Viswanathan N.V. and JayaderSreedhar, Polymer Science, Wiley Eastern Ltd, New Delhi.
(12) Billmeyer F.W., Text book of Polymer Science, John Wiley and Sons.
(13) S.M.Mukerji and S.P.Singh, Reaction Mechanism in Organic Chemistry, McMillan Publishers.
(14) S.P.Bhutani, Chemistry of Biomolecules, Ane Book Pvt Ltd.
(15) O.P.Agarwal, Chemistry of Natural Products, Goel Publications.
(16) T.L.Gilchrist, Heterocyclic Chemistry, Pearson Education, New Delhi.
(17) V.K.Ahluwaliya, Organic Reaction Mechanisms, Narosa Publishing House, New Delhi.

University of Kerala
MODEL QUESTION PAPER SEMESTER VI
First Degree Programme in Chemistry
Semester VI Core Course – IX Course Code CH1642 Credit 4
ORGANIC CHEMISTRY III
2017 admission onwards

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. Draw the structure of D-Arabinose and D-Ribose?
2. What are epimers?
3. Write the IUPAC name of (i) Furan and (ii) quinoline.
4. Write the structure of chloroquine.
5. What is isoelectric point?
6. What is natural rubber chemically?
7. Write any two biological functions of lipids.
8. What is soap?
9. Write the monomers of the following polymers (i) PTFE (ii) PP.
10. What is Frankland reagent? (10 X 1 =10 Marks)

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. Explain inversion of cane sugar.
12. Write any two industrial applications of cellulose.
13. Compare the aromaticity of furan and thiophene.
14. Write the structure of pyramidine bases present in nucleic acids.
15. Define the terms (i) saponification value and (ii) iodine value.
16. What is isoprene rule?
17. What are essential and non-essential amino acids?
18. What is denaturation of protein?
19. Differentiate oils and fats.
20. Define the terms M_n and M_w.
21. What is NBS? What is its use?
22. What are active methylene compounds? Give examples.

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. How can you interconvert glucose and fructose?
24. What is mutarotation? Explain its mechanism.
25. Explain the synthesis of amino acid by (i) Strecker and amidomalonate synthesis.
26. What are vitamins? How are they classified? Write the structure of Vitamin A and C.
27. What is tacticity? Explain it by taking poly propylene as an example.
28. What is Bakelite? How is it prepared? Give its important applications.
29. Write a short note on the structure of DNA.
30. Discuss the mechanism of Reformatsky reaction.
31. Elucidate the structure of conine.

(6 X 4 = 24marks) SECTION – D

(*Answer any2 question. Each question carries 15 marks*)

32. (a) Discuss the cycic structure of glucose

(b) Briefly explain the structure of starch and cellulose.

(c) (i) Why glucose and fructose form same osazone?

(ii) How fructose reacts with the following reagents? (1) Na/Hg and H_2O (2) CH_3OH and dry HCl (3) Fehling's solution.

33. (a) Explain the Fischer-Indole synthesis.

(b) What are sulphadrugs? Give examples. Explain the mode of action of sulpha drugs.

(c) What are terpenes? How are they classified? Write the structure of limonene and menthol.

34. Write brief note on the following : (a) Replication of DNA

(b) Merrifield synthesis

(c) Structure of protein

35. (a) Explain the synthetic applications of ethyl acetoacetate.

(b) How Grignard reagent is prepared? Explain its importance in the synthesis of primary, secondary, tertiary alcohols and carboxylic acid. (c) Explain the mechanism of cationic and anionic polymerization.

(15 X 2 = 30marks)

B.Sc. Chemistry Programme

Semester VI Core Course –X Course Code – CH1643 Credit 4

PHYSICAL CHEMISTRY- PAPER III [72 hours]

Aim of the course: To provide an insight into the thermodynamic and kinetic aspects of chemical reactions and phase equilibrium. To give an insight to the various electrochemical systems.

Objectives: The main objective of the course is to study the basics of electrochemistry and its importance to modern industry and technology. The course introduces various types of reactions and the different factors that determine the rate of chemical changes. The course also includes the study of the phase diagrams of one, two and three component systems and elementary ideas of photochemistry.

Module I: Chemical Kinetics &Catalysis 12 hrs

Order of reaction, Derivation of integrated rate equation of zero, first, second and nth order reaction, determination of order of reactions:- Graphical and analytical methods using integrated rate equations, Fractional life- method, Differential rate equation method, Isolation method. Qualitative idea of Complex reactions:- (a) opposing reactions (b) first order consecutive reactions (c) parallel reactions. Qualitative idea of chain reactions. Influence of temperature on rate of reaction: Arrhenius equation, Determination of Arrhenius parameter, Energy of activation and its significance. Collision theory, Derivation of the rate equation for a second order reaction based on collision theory, unimolecular reactions- Lindemann mechanism, steady state approximation.

Catalysis:- Theories of catalysis, Intermediate compound formation theory, steady state method, Enzyme catalysis, Michaelis-Menten law.

Module II: Chemical and Ionic Equilibria 12 hrs

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action, relation between Kp,Kc and Kx.

Le-Chatelier's Principle – Application in Haber process and dissociation of PCl_5.

Reaction isotherm, Temperature dependence of equilibrium constant, Pressure dependence of equilibrium constant, Application of Clausius-clapeyron equation in physical equilibria.

Ionic equilibrium : Ionic product of water, Effects of solvents on ionic strength, levelling effect, Pka and Pkb values, solubility product and common ion effect and their applications, pH and its determination by indica tor methods, buffer solution, buffer action, Henderson's equation, buffer capacity - hydrolysis of salts of all types, degree of hydrolysis and hydrolytic constant, determination of degree of hydrolysis, relation between hydrolytic constant and ionic product of water

Module III: Phase Equilibria 12 hrs

Phase Equilibria:-Terminology, the phase rule, thermodynamic derivation of phase rule and its application to (a) water system (b) sulphur system (c) solid-liquid equilibria involving simple eutectic system such as Pb-Ag system, KI-water system, freezing mixtures, thermal analysis and desilverisation of lead (d) solid-liquid equilibria involving compound formation with congruent and incongruent melting points:- $FeCl_3$- H_2O system and Na_2SO_4-H_2O system (e) solid–gas system- decomposition of $CaCO_3$, dehydration of $CuSO_4.5H_2O$, deliquescence and efflorescence.

Module IV: Binary Liquid Systems 12 hrs

Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures, Raoult's law, vapour pressure- composition and temperature-composition curves, fractional distillation, deviation from Raoult's law, Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST, Introduction to three component system, distribution law, its thermodynamic derivation, limitations of distribution law, application of distribution law to the study of association and dissociation of molecules, solvent extraction. (9hrs) Photochemistry: .

Grothus-Draper, Beer- Lambert and Stark- Einstein laws, Quantum yield, Reason for very low and very high quantum yields, Rate equation for decomposition of hydrogen iodide, Qualitative treatment of H_2-Cl_2 reaction and H_2-Br_2 reaction, Fluorescence and phosphorescence, chemiluminescence and photosensitization, Explanation and examples . (3hrs)

Unit V: Electromotive Force 15 hrs

Electrochemical cells(brief explanation) Reference electrodes-standard hydrogen electrode, calomel electrode, Types of electrodes-Metallic electrodes, anion reversible electrodes and redox electrodes, Electrode reactions and cell reactions, Derivation of Nernst equation for electrode potential and cell potential, Gibb's Helmholtz equation and EMF of a cell, calculation of ΔG, ΔH and ΔS from EMF data. Concentration cells with and without transference, electrode and electrolyte concentration cells, derivation of equation for the EMF of concentration cells with and without transference, Liquid Junction Potential,. Introduction to over voltage and polarization. Applications of potential measurement:- Determination of ionic product of water, hydrolysis constant and solubility product, pH value using quinhydrone and glass electrode, potentiometric titrations of acid-base and redox reaction. (12hrs)

Fuel cells :- Hydrogen-Oxygen fuel cell, Hydrocarbon – Oxygen fuel cell

Primary-Mercury cell, Dry cell and secondary cells –Lead acid cell, Li-ion cell Corrosion,

Prevention of corrosion . (3hrs)

Module VI: Electrical Conductance 9 hrs

Inter ionic attraction theory, Debye-Huckel-Onsager equation (Qualitative treatment only) activity and activity coefficient of electrolytes, Kohlrausch's law and its applications , Wein effect, Debye-Falkenhagen effect, Walden's rule. Ionic mobilities:- Transference number and its determination by Hittorff's and moving boundary methods, abnormal transference numbers, Applications of conductivity measurements:- Determination of degree of dissociation of weak electrolytes, degree of hydrolysis, solubility of sparingly soluble salts, conductometric titrations involving strong acid - strong base, strong acid-weak base, weak acid- strong base, weak acid-weak base and precipitation.

At least 100 problems are to be worked out from all units together. 30% of the questions for Examination shall contain problems.

References:

1. Advanced Physical Chemistry ,Gurdeep Raj, Goel publishing house
2. Elements of Physical Chemistry ,Glasstone and Lewis,Macmillan
3. Physical Chemistry ,P.C.Rakhit,Sarat Book House,Calcutta
4. A Text book of Physical Chemistry ,K.L.K.Kapoor,Vol 1,3 & 4, Macmillan

5. Physical Chemistry,R.StephenBerry,Stuart A. Rice & John Ross 2nd Edn, Oxford
6. Physical Chemistry ,Levin, 5th edn ,TMH
7. Physical Chemistry , G.M .Barrow, 6th edn, The McGRAW-HILL Companies ,INC
8. Priniciples of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co 9. A.S.Negi and S.C.Anand, A text book of Physical Chemistry, New Age International publishers.

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2017 admissions onwards
Semester VI Core Course X: Course Code CH1643 Credit 4
Physical Chemistry – III

Time: 3 Hrs Total marks: 80

Section A

Answer all the questions Each question carries 1 mark

1. Give the Arrhenius equation.
2. Write the integrated rate equation for a first order reaction.
3. Give the relation between hydrolytic constant, dissociation constant and ionic product of water of a salt of strong acid and weak base.
4. The solubility of AgCl in water at 250C is 0.00179 g/L. calculate its solubility product at 25 ^{0}C.
5. Write Debye- Huckel- Onsagar equation.
6. Write the reduced phase rule equation.
7. Give an example for a system having upper cum lower CST.
8. Give the Nernst equation for the potential of a copper electrode.
9. What is meant by quantum yield of a photochemical reaction?
10. Represent the electrochemical cell formed when Zn electrode is coupled with Ag electrode.

Section B

Each question carries 2 marks (Short answer) .Answer any 8 questions

11. Define buffer solution and buffer index .
12. Define the term activation energy. Why different reactions proceed at different rates? 13.Give one example each for a consecutive and a parallel reaction
14. What is meant by common ion effect? Explain with an example.
15. Describe with example (i) Triple point (ii) Eutectic point
16. Explain the term congruent melting point with an example
17. Write a note on conductometric titration of acetic acid against sodium hydroxide?
18. What is Debye Falkenhagen effect?
19. How will you construct a calomel electrode?
20. What is meant by liquid junction potential? How can it be almost eliminated?
21. What are azeotropes ? Explain with an example.
22. What is critical solution temperature? How does it vary by the addition of an electrolyte?

Section C

Each question carries 4 marks (Short essay). Answer any 6 questions

23. The rate constant of a second order reaction is 5.70 x 10^{-5} $dm^3 mol^{-1} S^{-1}$ at 25^0C and 1.64 x 10^{-4} $dm^3 mol^{-1} S^1$ at 40^0C. Calculate the activation energy and the Arrhenius preexponential factor.
24. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 500 ml? Dissociation constant of acetic acid at 250C is 1.75 x 10-5.
25. Explain the principle of freezing mixture by taking KI – H2O system as an example.
26. State and explain Nernst distribution law. What are the limitations of the law?
27. What are fuel cells? Describe H2 – O2 fuel cell and its cell reactions.
28. Derive Clausius- Clapeyron equation and mention its applications . 29.Explain the terms (i) Fluorescence (ii) Phosphorescence
30. What are the laws of photochemistry , explain ?
31. Explain the phase diagram of Pb-Ag system.

Section D

Each question carries 15 marks (essay) Answer any two question

32. a) using Le Chatliers Principle, describe the effect of temp, P and concentration for the following systems in equilibria:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

(5 marks x 3 = 15) b) Give the applications Nernst distribution law.

c) Elaborate on azeotropic mixtures.

33. a) How will you determine the transport number of ions using Hittorf method? (10 marks)
    b) Give the construction and working of SHE. (5 marks)
34. a) Derive van't Hoff equation for temperature dependence of equilibrium constant. (10 marks)
    b) The equilibrium constant for a reaction is 1× 105. Calculate the standard free energy change for the reaction in kilojoules at 25? C . (5 marks)
35. a)What is meant by CST. Explain different types of CST with examples (5 marks)
    b) Discuss various types of concentration cells. (10 marks)

For all Lab courses scheme of ESE is decided by the board examiners in each year

First Degree B.Sc Programme in Chemistry Lab course Semester II,

PART B. LABORATORY

COMPUTER LABORATORY

[No ESA for this component]

Computer Lab based instruction on the use of computer and internet in learning. Use of educational softwares, information mining from internet and using INFLIBNET/NICNET, NPTEL and VIRTUAL LABS OF MHRD. Word processing and document preparation. Use of Spread sheets in Data handling and presentation. Introduction to chemical structure drawing, visualization of molecules using chemistry softwares.

First Degree B.Sc Programme in Chemistry
SEMSTER I, III & IV Core Course-II Course Code CH1442
(Lab Course I) Core Course-IV
Three hours examination in semester IV. (Credit 2)

I. Qualitative Analysis (Micro Analysis)

a. Studies of the reactions of the following radicals with a view to their identification and confirmation: Pb^{2+}, Cu^{2+}, Bi^{2+}, Cd^{2+}, Sn^{2+}, Sb^{2+}, Fe^{2+}, Fe^{3+},

Al^3+, $Cr^{3+,}$ Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, K^+, NH^{4+}, CO_3^{2-}, S^{2-}, NO_2^-, NO_3^-, F^-, Cl^-, Br^-, I^-, BO_3^-,

acetate, oxalate, CrO_4^{--}, $PO_4^-$and SO_4^{2-}.

b. Systematic qualitative analysis by microscale methods of a mixture containing two acidic and two basic radicals from the above list (not more than one interfering radical). *II. Inorganic Preparations*

The following preparations are to be done:-

a. Potash alum
b. Hexamine cobalt
c. Chloride
d. Tetramine copper
e. Sulphate
f. Mohr's salt
g. Microcosmic salt
h. Sodium cobalti nitrate
i. Sodium nitro pruside
j. Manganese phthalocyanin
k. Potassium trioxalatochromate and
l. Potassium trioxalatoferrate

Semester V & VI Core Course- VIII Course Code CH1544 Inorganic Volumetric Analysis (Lab Course Number II)
and Core Course-IX physical Chemistry Experiments Course code 1545(Lab Course Number III)
(Credit 3) Six hours examination in semester VI

Inorganic Volumetric analysis- one burette titration only

(a) *Acidimetry and alkalimetry*

Preparation of carbonate free sodium hydroxide. Use of constant boiling hydrochloric acid Titrations using (1) Strong acid – strong base (2) Strong base – weak acid (3) Strong acid – weak base, determination of Na_2CO_3 and $NaHCO_3$ in a mixture by indicator method and NH_3 in an ammonium salt by direct and indirect methods.

(b) Permanganometry

The following determinations are to be done using standard permanganate solution (1) Ferrous iron (2) Oxalic acid (3) Hydrogen peroxide (4) Calcium (5) Nitrite and (6) MnO_2 in pyrolusite.

(c) Dichrometry

Determination of Ferrous iron using internal (& external indicator) and Ferric iron after reduction with SnCl2.

(d) Cerimetry

Standardisation of ceric ammonium sulphate with Mohr's salt. Determination of oxalic acid using ceric ammonium sulphate. *(e) Iodometry*

Standardisation of thiosulphate using KIO3, electrolytic copper and potassium dichromate. Determination of a copper salt.

(f) Precipitation titration

Determination of chloride in neutral medium. *(g) Complexometry (using EDTA)*

Standardisation of EDTA solution with ZnSO4 – determination of Zn, Mg, Ni and Ca – determination of permanent and temporary hardness of water.

Physical Chemistry Practicals

The following experiments are to be done :
Determination of

1.Partition coefficient of iodine between CCl_4 and H_2O or Partition coefficient of ammonia between $CHCl_3$ and H_2O 2.Transition temperature of a salt hydrate. Molar mass of a solute using transition point depression of a salt hydrate.

3. Depression in freezing point of a solid solvent by cooling curve method. Molar mass of a solute.
4. Critical solution temperature of phenol – water system.
5. Viscosity of binary mixtures and then concentration of an unknown mixture.
6. Surface tension of binary mixtures and then concentration of an unknown mixture.
7. Refractive indices of KCl solutions of different concentrations and then concentration of an unknown KCl solution.
8. Conductometric titration of NaOH Vs HCl.
9. Potentiometric titration of Fe^{2+} vs $Cr_2O_7^{2-}$
10. Potentiometric titration of $KMnO_4$ Vs KI
11. Determination of water equivalent of a calorimeter and heat of neutralisation of strong acid – strong base.
12. Kinetics of hydrolysis of an ester
13. Influence of KCl impurity on miscibility temperature of phenol – water system and then the determination of concentration of a given KCl solution.

2.COMPUTER SOFTWARE

Use of softwares and programmes in the physical chemistry experiments

1.Computer software like Scilab, Excel, etc to solve some of the plotting or calculation problems.
2.Determination of equivalence point of potentiometric and conductometric titrations using spreadsheet program.
3. Data analysis of kinetic experiments using spreadsheet program (determination of rate constant)
4.Plot scatter diagram.
5. Basic idea of software like Chemsketch or Chemdraw (any freely available structure drawing softwares)
6. Draw the structure of molecules using above mentioned software.
(Take prints and paste in the physical chemistry record)

B.Sc. Chemistry Programme Laboratory Course
Semester VI Organic Chemistry Experiments Core Course-XIII Credit-3 Course Code CHI644 (Lab Course IV),
and Course Code CHI645 Gravimetry Core Course-XIII (Lab Course V) Six hours examination in semester VI

I. Organic Chemistry Practicals (micro scale) 1.Tests for

elements : Nitrogen, halogens and sulphur

2. Determination of physical constants
3. Studies of the reactions of common functional groups using known organic compounds.
4. Qualitative analysis with a view to characterization of the functional groups. The following compounds may be given for the analysis : chlorobenzene, benzyl chloride, phenol, o – m – p – cresols, naphthols, resorcinol, benzaldehyde, acetophenone, benzophenone, benzoic, phthalic, cinnamic and salicylic acids, ethyl benzoate, methyl salicylate, benzamide, urea, aniline, o – m, p – toluidines, dimethylaniline, nitrobenzene, o – nitro toluene p – nitro toluene, m – dinitrobenzene, naphthalene, anthracene, glucose and sucrose.
   Organic preparations involving halogenation, nitration, oxidation, reduction, acetylation benzoylation, hydrolysis and diazotisation (TLC of the reactant and Product) . Isolation of an organic compound from a natural source eg. Hippuric acid from cow's urine.
5. Chromatography
   a. Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars
   b. Separation of a mixture of dyes by column chromatography.
6. Organic estimation
   a. Molar mass determination of an acid and base by titration method
   b. Determination of the phenol/aniline by bromate – bromide method
   c. Determination of the equivalent mass of an ester

II Gravimetry

The following determinations are to be done using silica crucible (1) Ba as $BaSO_4$ (2) Sulphate as $BaSO_4$ (3) Iron as Fe_2O_3 (4) Calcium as $CaCO_3$ (5) Aluminium as Al_2O_3 and Magnesium as $Mg_2P_2O_7$

The following determinations are to be done using sintered crucible

(1) Magnesium as oxinate (2) Nickel using dimethyl glyoxime (3) Copper as copper thiocyanate and (4) Silver as silver chloride

Colorimetry (Using photo electric colorimeter)

Determination of Iron using thiocyanate and ammonia using Nessler's reagent.

REFERENCE

1. A.I.Vogel, "A text book of Qualitative Analysis including semi micro methods" Longmans.
2. V.V.Ramanujam, "Semi micro Qualitative Analysis"
3. E.S.Gilreath "Qualitative Analysis using semi micro method" Mc Graw Hill
4. A.I.Vogel, "A text book of Qualitative Inorganic Analysis" Longmass
5. A.I.Vogel, "Elementary Practical Organic Chemistry" Longmass
6. Day and Raman, "Laboratory Mannual of Organic Chemistry". Viswanathan
7. Mann and Saunders, "Practical Chemistry"
8. A.Findlay, "Practical Physical Chemistry"
9. R.C.Das and E.Behara, "Experimental Physical Chemistry", Tata Mc Graw Hill
10. N.K.,Vishnu, "Advanced practical organic chemistry" Vikas publishing house, New Delhi

The practical examinations of Lab course II (volumetric analysis), Lab course III (physical chemistry experiments) and Lab course IV (organic analysis) , Lab course V (gravimetric analysis are conducted at the end of VI semester with a duration of two days (6hours duration on each day).

First Degree Programme
Semester V and VI
Chemistry Project and Factory visit
Course Code – CH1646
No. of credit – 4 . Total ESE marks-100- (No CE marks)
Project

Aim of the course

To develop an aptitude for research in chemistry, to learn research methodology and literature search

Objective of the course

To inculcate proficiency to identify appropriate research topic and presentation

Specifications

Topics of chemical interest can be selected for the project. Project is to be done by a group not exceeding 5 students. Every student should submit typed (A4 paper, 12 Font, 1.5 Space, 20- 30 pages), spirally bind project report duly attested by the supervising teacher and the Head of the Department on the day of practical examination before a board of two Examiners for ESE. The viva-voce based on the project is conducted individually. Project topic once chosen shall not be repeated by any later batches of students. List of projects submitted year wise is to be maintained in a register and submitted before the examiners if requested.

The project report may contain the following sections:

1. Preliminary (Title page, declaration, certificate of the supervising teacher, content etc.)
2. Introduction with relevant literature review and objective
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion / Summary 7. References.

Study tour and Factory/ research institute visit

Students are directed to visit one research institute/ chemical factory preferably with in the state of Kerala. Scientifically prepared hand written study tour report along with photographs of candidate at the places of visit must be submitted by each student for ESE on the day of the examination of project evaluation.

The board of examiners can decide the scheme of evaluation of project , study tour report and viva voce

Open Course for Other Majors-
Semester-5 Credit-2 Course-CH1551.1
2017 admission onwards
Essentials of Chemistry

Module 1:Atomic structure and Periodic Classification of Elements (9hrs) Structure of atom- Fundamental particles, atomic mass, atomic number, isotopes. Bohr theory of atom. Orbitals- Quantum numbers, aufbau principle, Hund's rule; Pauli's exclusion principle. Electronic configuration of atoms - half and completely filled orbitals. Modern periodic table: Periods, Groups, Periodicity- valency, atomic radius, electronegativity, Ionisation potential, Electron affinity.

Module 2 :Nuclear Chemistry (9 hrs)

Natural radioactivity, Nature and types of radiations, Properties. Group displacement law. Radio active decay series. Decay rate. Half life period, Average life period, Unit of radioactivity. Radiation dose, artificial radioactivity, nuclear structure. Nuclear fission and Nuclear fusion. Rock dating- Radio carbon dating. (*elementary idea only*)

Module 3 :Polymer Chemistry (9 hrs)

Classification of polymer: Origin, structure, synthesis, Molecular forces. Commercially important polymers: Application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer: (*Examples Only*).

Module 4 :Chemistry in Biological Process (9hrs)

Vitamins: Vitamin-A, Vitamin-B2, Vitamin-C, Vitamin-D, Vitamin-E and Vitamin-K- Name, Source, Function and deficiency diseases. Enzymes- Classifications, characteristics, role, examples. Hormones - Sex hormones- Androgens, oestrogens, progesterone, Example, function. Cortical hormones- A few examples with function. Nucleic acid- RNA, DNA: Introduction- role in life process (*No structure or chemical reactions needed*)

Module 5 : Chemistry in action *(9hrs)*

Dyes: classification based on constitution, application, examples, uses. Drugs: Antipyretic, analgesic, antiseptic, disinfectants, tranquilisers, antibiotics structure, name and uses only. Soaps and detergents: Hard and soft soaps, anionic, cationic and non-ionic detergents, cleansing action of soaps, Explosives: TNT, TNG, RDX, Gun cotton: name, structure and action. (*No structure or chemical reactions needed*)

Module 6 :Environmental Chemistry *(9hrs)*

Air Pollution: Types of pollutant in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source and influence. Acid rain, Green house effect, ozone layer and its depletion. Water Pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents. Hard and soft water, Removal of hardness, disadvantage of hard water. Soil pollution : Due to pesticides, herbicide, fungicide, long term use of fertilizers, plastic waste.

References

1. M. C. Day and J. Selbin,“ Theoretical Inorganic Chemistry”.
2. H. S. Arniker,“ Essentials of Nuclear Chemistry:
3. B.K. Sharma “Environmental Pollution”.
4. Solomons- John- Wiley, “Fundamentals of Organic Chemistry”.
5. F.A. Carey, Mc. GrawHill ,“Organic Chemistry” Inc. 226
6. I.L Finar,“Organic Chemistry”, Vol. 1 Longman
7. Tewari, Mehrotra- Vikas&Vishnoi,“A Text book for Organic Chemistry:
8. M.K. JainJain,“ Principles of Organic Chemistry”.
9. A.K. Dey,“Environmental Chemistry”.

University of Kerala
Model Question Paper
2017 admission onwards
Open Course for other Majors Course CH1551.1
Essentials of Chemistry

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

1. Who discovered radioactivity?
2. Name any unit of radioactivity. 3.What is the expansion of DNA?
4. Write an example of a sex hormone.
5. Name an enzyme.
6. State Afbau principle.
7. Draw Px orbital.

8. Give an example of inorganic polymer.
9. Name any compound which causes acid rain.
10. What is the monomer of nylon-6,6?

(1x10 = 10 marks)

Section B

(2 marks each), Short answerAnswer any 8 questions

11. Name the pollutants in air?
12. What are the factors affecting the purity of water?
13. Explain Hund's rule of maximum multiplicity with an example.
14. Define electron affinity, explain with an example.
15. Distinguish between half life period and average life period.
16. Explain artificial radioactivity.
17. Write the structure and applications of polyhalo olefins.
18. What is vulcanization of rubber?
19. What are corticosteroidal hormones? Explain with example.
20. Distinguish between DNA and RNA.
21. How are dyes classified?
22. Explain cleansing action of soap

(2×8 = 16 marks)

Section C

(Each question carry 4 marks), (Short essay)Answer any 6 questions

23. Explain the source and hazards of fly ash and asbestos.
24. Explain briefly soil pollution.
25. What are periods and groups in the periodic table? What is periodicity?
26. Explain Bohr model of atom.
27. Distinguish between nuclear fission and nuclear fusion with examples.
28. What are Nylon 66, Melamine and Terylene?
29. What are the functions and deficiency diseases of Vitamin C, Vitamin D and Vitamin E.
30. Write a note on explosives.
31. Distinguish between addition and condensation polymerization.

(4×6 = 24 marks)

Section D

(15 marks each), (essay), Answer any two question

32. a) What are quantum numbers? Explain.
    b) State Pauli Exclusion Principle. Expalin their significance.
    c)Explain stability of half-filled and completely- filled orbitals. (5x3 = 15 marks)

33. a) Write a note on Group Displacement law and radioactive decay series.
    b) What is carbon dating? In an archaeological piece of wood 14C activity is 10 % of the activity found in a fresh wood. Calculate the age of the archaeological piece (half life of 14C is 5760 years.).
    c)Write a note on vitamin deficiency disease. (5x3 = 15 marks)

34. a) What are the different methods for the analysis of oils and fats?
b) What is meant by DNA? Name the sugar unit present in DNA.
c)Write anote on vat dyes. (5x3 = 15 marks)

35. a) Explain the cleansing action of soap.
b) What is antibiotic? Give the names of the first antibiotic and the scientist who discovered it.
c)Give an account of the green house effect. (5x3 = 15 marks)

Open Course For Other Majors-
Semester-5 Credit-2 Course Code-CH1551.2
2017admission onwards

Fundamentals of Chemistry & Its Application to Everyday Life

Module 1 Evolution of Chemistry *9 hrs*

Evolution of Chemistry - ancient speculations on the nature of matter, early form of chemistryalchemy, Robert Boyle and the origins of modern chemistry in the latter 1600s - origin of modern chemistry - Antoine Lavoisier and the revolution in chemistry - Role of Chemistry as a central science connecting
Physics, Biology and other branches of science. Basic ideas of interdisciplinary areas involving Chemistry

Module 2 Atomic structure Atom- model of Dalton- Thomson – Rutherford and Bohr. Nature of electron proton and neutron – atomic number – mass number- isotopes -state the relative charges and approximate relative masses of a proton, a neutron and an electron - describe, with the aid of diagrams, the structure of simple atoms as containing protons and neutrons (nucleons) in the nucleus and electrons arranged in shells (energy levels) (no knowledge of s, p, d and f orbitals);

Module 3–Periodic table *9 hrs*

The Periodic Table - Periodic trends, Group properties - describe the relationship between group number and the ionic charge of an element- similarities among the elements in the same group - metallic to non-metallic character from left to right across a period of the Period Table- Properties of elements in Group I and XVII using the Periodic Table

Module 4 Structure and properties of materials *9 hrs*

Elements, compounds and mixtures – elementary idea of ionic bond and covalent bond- compare the structure of simple molecular substances, e.g. methane; water, carbon dioxide, iodine, with those of giant molecular substances, e.g. poly(ethene); sand (silicon dioxide); diamond; graphite in order to deduce their properties compare the bonding structures of diamond – graphite, electrical conductivity.

Module 5 Chemicals used in everyday life. *9 hrs*

Household materials – Major chemical ingredients (*No structural formula and preparation needed*), method of action and possible hazards/toxicity of : Match Box- Household bleach – Soap- detergent— cooking gas – tooth paste – shampoo-hair dye- nail polish- whitener-moth balls –fire crackers.

Module 6 Chemicals in food and beverages *9 hrs*

Important chemical ingredients/ taste makers used in packed food - soft drinks - and its health hazards. Chemicals in food production - fertilizers used in natural sources - Fertilizers urea, NPK and Super phosphates - uses and hazards. Adulterants in milk, ghee, oil, coffee powder, tea, asafoetida, chilli powder, pulses and turmeric powder - identification. artificial sweeteners - food preservatives.

University of Kerala

Model Question Paper

2017 admission onwards

Open Course for other Majors Course

Semester V Course Code CH1551.2 Credit 2

Fundamentals of Chemistry & Its Application to Everyday Life Time: Three Hours Maximum Marks : 80

Section A

(answer in a word / sentence) Answer all questions

1. What is superphosphate?
2. Who is the Father of Modern Chemistry?
3. How many atoms are present in a molecule of ozone?
4. Define isotopes.
5. What is a diamond made up of?
6. Which element has the electron configuration 2,1.
7. Name a liquid element.
8. What is the shape of water molecule?
9. How many valence electrons are there in carbon?
10. Name the main compound present in cooking gas.

Section B

Each question carries 2 marks (Short answer type).Answer any eight questions .

11. Name any two Toxic Chemicals in Cosmetics
12. Obtain the electron configuration for (a) N; (b) F.
13. Explain Hund's rule of maximum multiplicity with an example.
14. Define electron affinity, explain with an example.
15. Which of the following elements Li, Be, B, C, N, O, F and Ne are metals?
16. Explain Bohr model of atom.
17. Why is the electronegativity value of most noble gases equal to zero?
18. What are the Health Effects of Drinking Soda?

19. Which do you expect to have more metallic character, Lead (Pb) or Tin (Sn)

20. What is a Match Head of match stick made of?

21. Explain why graphite conducts electricity whereas diamond doesn't.

22. Is the reactivity of group I metals increasing or decreasing down the group? Explain why? 2×8 = 16

Section C

Each question carries 4 marks(Short essay type)*Answer any six questions*

23. Explain the colour of firecrackers.

24. What is the difference between covalent and ionic bonding?

25. What are periods and groups in the periodic table? What is periodicity?

26. What are adulterants.

27. How is Thomson's model of the atom different from Dalton's model of atom?

28. What's the difference between an oxidation number and an ionic charge?

29. Explain the health hazards associated with drinking soft drinks?

30. How can metallic character change across a period?

31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

4×6 =

24Section D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
c. Describe the metallic character of elements in a period.

33. a.Explain the role of some chemicals in household items.(7.5 marks)
b.Write a short note on food adultration. (7.5 marks)

34. a.Write a short note on the uses and hazards of fertilisers. (10 marks)
b.Draw the structure of carbon and sodium containing nucleons. (5 marks)

35. a.compare the structure of substances, methane, water, carbon dioxide and iodine, with ethane and silicon (10 marks)
b.compare the bonding structures of diamond – graphite. (5 marks)

Open Course for Other Majors

Semester-V Credit-2 Course Code -CH1551.3

2017 admission onwards

Environmental Chemistry

Module -I Environmental Components: 9 hrs

Structure and composition of the, Atmosphere, hydrosphere, biosphere and Lithosphere – composition of atmosphere

Module -II Water pollution: 9 hrs

Sources, its effect and control; Sampling and measurement of water quality and their analysis, water quality standards, BOD and COD Hard water – soft water Eutrophication and restoration of lakes.

Module -III Air Pollution: 9 hrs

Types and sources of air pollution, Common Air Pollutants - Effects of air pollution; Smog – ozone layer depletion – green house effect – acid rain

Module -IVSoil Pollution: 9 hrs

Sources, types, effects and control of: Land pollution, Marine pollution, Thermal Pollution and Radioactive pollution. Waste separation, storage and disposal ; Waste Reduction, Recycling and Recovery of materials. Plastics and their misuses.

Module -V Major environmental disasters 9 hrs

Major environmental disasters - - mercury poisoning in Minamata, Japan ,Itaiitai disease due to cadmium poisoning in Japan - Love Canal toxic waste site, Seveso disaster chemical plant explosion - Bhopal disaster - Chernobyl incident,

Module -VI Major environmental laws: 9 hrs

Environment (Protection Act) – The Air (Prevention and control of pollution) Act – The water (Prevention and control of pollution) Act – The wild life protection Act – Forest conservation Act – The Ozone Depleting Substances (Regulation and Control) Rules – The Plastic Waste (Management and Handling) Rules - Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (elementary ideas only)

Reference

1. S. K. Banerji, “Environmental Chemistry”.
2. K. De “Environmental Chemistry - An introduction”
3. B. K. Sharma “Air Pollution”.
4. V. K. Ahluwalia “Environmental Chemistry”
5. G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”
6. S.K.Mohanty, Environment and Pollution Laws, Universal Law Publishing Co. Pvt Ltd

University of Kerala
Model Question Paper
2017admission onwards
Open Course for other Majors Course Code CH1551.3 Credit -2
Environmental Chemistry

Time: 3 hours Maximum marks: 80

Section A
Answerall questions (Eachanswercarries 1 mark)

1. What you meant by Triple R in waste management ?.
2. What type of pollution causes acid rain?
3. What are the misuses of plastics?
4. What are the three major man made sources of air pollution?
5. What kind of materials are discharged into the seas?
6. What increases the amount of carbon dioxide in the atmosphere?
7. Explain the action of zeolites on hard water.
8. What are freons?
9. Define pollution
10. What is fly ash

(10x1=10)Sectio
n B
(short answer type) (Answer any 8 questions, Each answer carries 2 mark)

11. How is pollution related to acid rain?
12. How does ocean pollution affect sea animals?
13. What are the main concepts of Green Chemistry
14. Write short note on Radioactive pollution
15. Discuss the major composition of earth's atmosphere 16.Write about the cause and consequence of Chernobyl incident
17. What is BOD and COD?
18. What causes radioactive pollution?
19. Distinguish between Hard water and soft water.
20. What is the goal of Forest Conservation Act?
21. What is the Greenhouse effect and what is its cause? 22.What are the types of air pollutants ?

(2×8 = 16)

SectionC
(Short essay type) each question carries 4marks. Answer any 6

23. Write short note on volatile organic compounds.
24. How can thermal pollution be prevented?
25. How do you control Radioactive pollution?
26. What is smog? How does smog arise?

27. What is Eutrophication

28. Write a note on Rio-Declaration.

29. Explain the various layers of the Atmosphere

29. What is Air Pollution? How can air pollution be minimized?

30. Briefly explain about the components of atmosphere.

6×4 = 24

Section D.

Answer any 2 from the following. Each question carries 15 marks

32. (a) Explain Hardness of water and the different types. (5 marks) (b) Discuss about the various sources of water pollution. (5 marks)
(c) What are the control measures for water pollution ? . (5 marks)

33. (a) Write short note on causes and problems of ozone layer depletion? (b) Explain the various types of smog.
(c) Discuss the Ozone Depleting Substances (Regulation and Control) Rules

34. (a) Explain thermal pollution
(b) Discuss about plastics and their misuses
(c) Discuss about Chernobyl disasters

35. (a) Discuss about green chemistry
(b) Explain Montreal protocol and Kyoto protocol
(c) The water (Prevention and control of pollution) Act

15 × 2= 30

B.Sc. Chemistry programme Elective Course
Semester-6 Credit-2 Elective Course, Course Code – CH1651 .1
Supramolecular, Nano Particles and Green Chemistry---54 hrs

Module I Green Chemistry-1 ---9hrs

Role of Chemical Industries in polluting the environment-Limitations of conventional waste managementpollution prevention-birth of green chemistryintroduction to the principles of green chemistry-atom economy calculation(simple reactions)-production of Ibuprofen-less hazardous chemical syntheses, designing safer chemicals-Bhopal gas tragedy- new greener syntheses, safer solvents and auxiliaries ionic liquids-super critical fluids CO_2 and H_2O, advantages of SCFs

Module II Green Chemistry-2 ---9hrs

Design for energy efficiency-principle of microwave oven, microwave assisted organic syntheses, simple examples- renewable feedstock- biodiesel, preparation, advantages, catalysis, green catalysts- inherently safer chemistry for accident prevention. Green chemistry practices in research, educational and commercial laboratories- lab safety signs- introduction to micro scale experiments.

Module III Chemistry of Nano Materials Part I 9 Hrs

Classifications of nanostructured materials, nano particles; quantum dots, nanowires, ultra - thinfilmsmultilayered materials. Synthesis of nanometre scale particles of colloidal semiconductors such as TiO_2, CdS, ZnO, $BaTiO_3$, by wet chemical methods, hydrothermal methods, and pyrolytic or high temperature methods. Carbon nanotubes fullerenes and graphene. Synthesis and purification of carbon nanotubes, Singlewalled carbon nanotubes and multiwalled carbon nanotubes, Structure-property relationships.

Module IV Chemistry of Nano materials Part II 9 hrs

Preparation of self-assembled monolayers, core shell nanoparticles and quantum dots. Properties of nanoparticles: optical, magnetic, mechanical, thermal and catalytic properties, characterisation of nano particles by AFM, STM and SEM. Applications of nanomaterials: Potential uses of nanomaterials in electronics, robotics, computers, sensors, mobile electronic devices, vehicles and transportation. Medical applications of nanomaterials.

Module V :Molecular recognition 9hrs

The concepts of molecular recognition, host, guest and receptor systems. Forces involved in molecular recognition. Hydrogen bonding, ionic bonding, p-stacking, vander Waal's and hydrophobic interactions.

Module VI Supramolecular chemistry: 9hrs

Introduction to molecular receptors-design principles: Tweezers, Cryptands and Carcerands, Cyclophanes, Cyclodextrins and Calixarenes- Typical examples Molecular recognition and catalysis- catalysis by cation receptors, anion receptors and cyclophanes.
Molecular recognition in DNA and protein structure

References

1. Anastas. P.T.; Warner, J.C.,"Green Chemistry; Theory and Practice", Oxford University Press; Oxford , U.K.,1998.
2. Lancaster,M,"Green Chemistry; An Introductory Text",Royal Society of Chemistry; Cambridge,UK, 2003
3. Rashmi Sanghi and M.M Srivasthava, "Green Chemistry Environment Friendly Alternatives", Narosa Publishing House,2006
4. T.Pradeep, "NANO: The Essentials", 'McGraw-Hill Education'. 5. D. Nasipuri "Stereochemistry of Organic Compounds", Wiley
6. J M Lehn, "Supramolecular Chemistry", V C H.
7. H Vogtle, "Supramolecular Chemistry", W iley.
8. P S Kalsi, J P Kalsi,"Bioorganic, Bioinorganic and supramolecular Chemistry", New Age International

University of Kerala
Model Question Paper
2017 onwards
B.Sc Chemistry Programme
Elective Course Semester VI Course Code CH1651.1 Credit 2
Supramolecular, Nano Particles and Green Chemistry

Time: Three Hours Maximum marks : 80

Section A.

Answer all questions. Each question carries 1 mark.

1. Define atom economy.
2. Write an example of green catalyst.
3. Between an addition and elimination reaction which is having a better atom economy?
4. Name a colloidal semiconductor.
5. Expand SAMS.
6. What is graphene?
7. Name the different allotropes of carbon.

8 . Name any two molecular receptors.
9.What are cryptands?
10. Define π stacking.

Section B.

Answer any eight questions. Each question carries 2 marks.

11. Write a note on Bhopal Tragedy.
12. Define Carbon efficiency.
13. Explain the limitations of conventional waste management.
14. Give any four lab safety signs with its meaning.
15.Write about the wet method of preparing colloidal semiconductors.
16.What are the magnetic properties of nanoparticles.
17. Briefly describe the catalytic properties of nano materials.
18. Explain the different types of SWCNTs.
19. What are the non-covalent bonds involved in molecular recognition?
20. Define host and guest in supramolecular chemistry.
21. Write a note on Cyclodextrins.
22. What are molecular tweezers?

Section C.

Answer any six questions. Each question carries 4 marks.

23. What are secondary electrons?
24. Write a note on safer solvents and auxiliaries.
25. Explain ionic liquids.
26. Write a note on biodiesel.
27. Describe the synthesis of quantum dots and mention its optical properties.
28. Explain the preperation of SAMs.
29 Discuss the potential applications of nanomaterials in computers, sensors, and Medical applications.
30. Discuss the various aspects of molecular recognition involved in the structure of DNA.
31 Write notes on cation and anion receptors.

Section D

Answer any two questions. Each question carries 15 marks.

32.(a)Explain the twelve principles of green chemistry.(10marks)
(b) Explain microwave assisted organic syntheses with an example.(5marks)
33. (a) Explain the principle and working of SEM
(b) Write a note on synthesis and purification of carbon nanotubes.
34. Write short notes on (a) calixarenes (b) Cyclodextrins (c) cyclophanes.
35. Write short notes on(a) molecular recognition(b) preparation biodiesel(c)non bonded interactions.

B.Sc Chemistry ProgrammeELECTIVE
COURSE

Semester-6 Credit-2 Course Code – CH1651.2

Computational, Combinatorial and Physical Organic Chemistry 54 hrs

Module I Introduction to Computational Chemistry 9 hrs

Web resources in chemistry learning Introduction to structure drawing, spread sheet and chemistry related softwares. Approximate methods in Quantum mechanics- Many electron atoms: Self consistent field method. Chemical bonding: Perturbation theory and variational principle. MO theory of hydrogen molecule ion. VB theory of hydrogen. Concept of resonance.

Module II Computational Methods *9 hrs*

Brief description of computational methods: ab initio, semi empirical, DFT and molecular mechanics. RHF, ROHF &UHF methods Basis sets, STO &GTO. Z-matrix of simple molecules H_2O, CO_2& NH_3. Common computational and visualization softwares

Module III: Combinatorial Chemistry Introduction *9 hrs*

Early development, what is combinatorial synthesis, library synthesis on resin beads, solid phase chemistry, Merrifield peptide synthesis, support for solid phase synthesis, parallel synthesis and mix and split library synthesis.

Module IV Combinatorial Synthesis *9hrs*

Libraries on multipins, libraries on wicks, libraries on laminar solid phases (no detail study).Solution phase library synthesis- eg.-, Hantzsch synthesis of aminothiazole, peptide and nonpeptide libraries(eg. only), Applications of combinatorial chemistry in drug discovery.

Module V : Introduction to Physical organic chemistry *9 hrs* Classification of mechanism with suitable examples. Bond breaking mode – Heterolytic, Homolytic and Pericyclic Nature of reaction – Substitution, Elimination, Addition, Pericyclic and Rearrangement reactions. Nature of reagent – Nucleophilic, Electrophilic and Free radical. Thermodynamic and Kinetic control of reaction. The Hammond postulate (qualitative treatment). The thermodynamic functions – ΔH, ΔS and ΔG and their determination from Arrhenius equation. Role of above thermodynamic functions in mechanistic probe of reactions. Methods of determining mechanism, Identification of products, Detection of intermediates, Catalytic study, Isotopic labeling, Stereochemical evidence, Kinetic evidence.

Module VI Correlation of structure with reactivity *9 hrs*

The effect of substrate structure – Differences in mechanism for primary, secondary and tertiary systems. The effect of a and ß substitution – the +I and –I effects (Inductive effects of electron releasing and electron withdrawing groups at a and ß positions). Substitution of mono and bicyclic (at a and ß positions) aromatic rings (Resonance effects). Hyperconjugate effects. Neighbouring group effect nonclassical bridge head - Steric effects – B-strain, Strain in aliphatic cyclic systems. Steric inhibition of resonance – ortho effect and a-effect, The Hammett equations.

References :

1. Guy H. Grant and W.Graham Richards, "Computational Chemistry", OCP(29) 2. Christopher J. Cramer, John Wiley,"Essentials of Computational Chemistry",

3. Frank Jenson, "Computational Chemistry".
4. Ira N. Levine," Quantum Chemistry".
5. David Young, "Computational Chemistry A Practical Guide for Applying Techniques to Real World Problems", Wiley Interscience.
6. N K Turret, "Combinatorial Chemistry", (Oxford Publication)
7. Jerry March "Advanced Organic chemistry", 3rd edition, Wiely International (Indian edn New Delhi) Chapter 6 and 10
8. P S Kalsi," Text of organic Chemistry", Mac million India ltd 1999 Ch 2
9. M K Jain and S C Sharma," Modern Organic Chemistry" , Vishal Publishing Co, 2004, Chapter 3,4, 15

UNIVERSITY OF KERALA

B.Sc Chemistry Programme, Semester VI

2017 admission onwards

MODEL QUESTION Elective Course- Course Code CH1651 .2 Credit 2 Computational, Combinatorial and Physical Organic Chemistry Time: Three Hours

Max. Marks : 80

Section A

Answer all questions. Each question carries 1 mark.

1. Write Arrhenius expression and explain the terms.
2. What is RHF?
3. What are nucleophilic reagents? Give examples.
4. Name any two structure drawing softwares.
5. Write Hammett equation.
6. Give one example solution phase library synthesis.
7. Write any two examples for poly amide resin.
8. Propene is more stable than ethane. Why?
9. What is combinatorial synthesis?
10. Write any two examples for heterolytic bond breaking reaction. 1 X 10 = 10 Marks Section B

Answer *any eight* questions from the following. Each question carries 2 marks.

11. What are the web resources in learning Chemistry?
12. What is a basis set ?
13. What are the major mechanisms of organic reactions ?
14. Distinguish between STO & GTO.
15. Explain the advantages of combinatorial synthesis.
16. What is meant by electrocyclic reaction. Give one example.
17. What are the applications of combinatorial synthesis. 18. What are multipins used in combinatorial synthesis
19. Explain kinetic requirements of reaction.
20. Explain Hammond postulate.
21. Explain +I and – I effects.
22. Explain isotopic labeling in the study of organic reactions. 2× 8 = 16 Section C

Answer *any six* questions from the following. Each question carries 4 marks. 23. Draw the Z matrix of H_2O & NH_3

24. Why SEM is called parametrisation method
25. How can a eight – member dipeptide library is synthesized ?
26. Explain non-peptide libraries.
27. How are the intermediates detected?
28. Explain substitution reactions of naphthalene.
29. Explain the effect of leaving group in aliphatic substitution reactions.
30. What is self consistent field method.
31. Explain mix and split library synthesis. 6 X 4 = 24 Marks

Section D

Answer *any two* questions from the following. Each question carries 15 marks

32. (a)Explain MO theory of hydrogen molecule ion. (b)Explain VB theory of hydrogen .
10 + 5 = 15 Marks
33. (a)Explain neighboring group participation with examples. (b)Explain sterric effects and B-strain. 7.5 + 7.5 = 15 Marks
34. (a) How does the structure of substrate affect the aliphatic nucleophilic substitution? (b) Comment on the effect of substituent on nucleophilic substitution reaction.
7.5 + 7.5 = 15 Marks
35. (a) Write a brief description of methods(a) ab initio(b)DFT (c) molecular mechanics.

5+ 5+ 5 = 15 Marks

B.Sc Chemistry Programme
ELECTIVE-COURSE
2017admission onwards
Semester-6 Credit-2 Elective Course Code - CH1651.3
POLYMER CHEMISTRY 54hrs

Module I:- Introduction *9hrs*

Brief history of macromolecular science, general characteristics of polymers in comparison with common organic compounds. Nomenclatures. Distinction between plastics, elastomers and fibres. Natural polymers- cellulose, silk, gums and resin . Types of polymers- thermoplastics and thermosettings, functionality concept. Concept of cross linked polymers. Types of polymerization- addition, condensation, ionic, co-ordination. Addition – polymerisation – mechanism, initiation , propagation and termination processes, initiators, inhibitors. Mechanism of ionic polymerization

Module II : Methods of polymerization *9hrs*

Methods of polymerization-bulk, suspension, emulsion, solution necessity of copolymers and copolymerization, blocks and graft copolymers. Detailed study of the following thermosetting polymers with respect to synthesis, chemistry, properties and applications. (a) phenol- formaldehyde resins (b) amino resins_ urea- formaldehyde and melamine-formaldehyde resins (c) polyurethanes (d) epoxy resins- grades of epoxy resins, curing process and its importance with mechanism (e) poly carbonates, silicones

Module III: : Elastomers-I *9hrs*

Polyisoprene, polybutadiene, neoprene. Detailed study of the following thermoplastic polymers with respect to synthesis, chemistry, properties and applications. Polyolefins ,polyethylenes_HDPE, LDP,LLDP, polyvinyl chloride-grades of PVC, Teflon, Polystyrene-homopolymers, copolymers such as SBR, ABS, SAN.

Module IV : Elastomers 2 *9hrs*

Vinyl polymers- polyvinyl acetate and its modifications like PVA, PVB and polyacetals. Polyamides -nylon -6, nylon-66 and other nylons. Poly ethers and poly esters, terephthalates. Cellulosics such as esters, ethers, acetates, butyrates, nitrate, CMC; regenerated cellulose.

Module V: Experimental methods-1 *9hrs*

Molecular weight and molecular weight distribution – number , weight and viscosity average molecular weights of polymers, methods of determining molecular weight, practical significance of molecular weight distribution, size of polymers. Introductory concepts of kinetics of polymerization and Carother's relation. Glassy state, glass transition temperature, TGA, factors affecting GTT, crystallinity in polymers.

Module VI : Experimental Methods –II *9hrs*

Viscosity, solubility, optical properties, electrical properties, thermal properties, mechanical properties of polymers. Degradation of polymers by thermal , oxidative ,mechanical and chemical methods. Polymer processing- compression moulding, casting, extrusion , fibre spinning, injection moulding, thermoforming, vulcanization of elastomers, polymer industry in India.

References

1. Bllmeyer, "Textbook of polymer science", John Wiley and Sons
2. D.D. Deshpande, "Physical chemistry of macromolecules", Vishal publications, New Delhi, 1985
3. V.R. Gowariker, N.V. Viswanathan and J.Sreethan, "Polymer Science", Wiley Eastern Ltd, 1986

B.Sc Chemistry Programme
Model Question Paper
Elective Course Semester VI Course Code CH1651.3
2017 admission onwards
Polymer Chemistry

Time: Three Hours Maximum Marks: 80

Section A

Each question carries 1 mark (Answer in one word\sentence)

Answer all questions

1. What are elastomers?
2. How is melamine-formaldehyde resin prepared?
3. Write a note on Nylon 66.
4. Mention the monomer unit of neoprene.
5. Define copolymers.
6. Explain extrusion.
7. Define fibre spinning.
8. Explain emulsion polymerisation
9. Give two examples of natural polymers10. What is SBR and SAN?

Section B

Answer any eight questions. Each question carries 2 marks.

11. Write a note on Condensation polymerisation.
12. Explain the synthesis of HDPE.
13. Write a note on Polyurethanes.
14. Explain number, weight and viscosity average molecular weight.
15. Define graft copolymers.
16. Explain the preparation of PVC.
17. What are epoxy resins?

18. Explain the vulcanisation of ealstomers.
19. Write the mechanism of ionic polymerisation.
20. Explain the chemical methods of degradation of polymers.
21. Explain polymer processing.
22. Distinguish between thermoplastics and thermosetting plastics.

Section C

Answer any six questions. Each question carries 4 marks.

23. Write a short note on silicones?
24. What are the methods of determining molar mass?
25. Write notes on (1) compression (2) moulding (3) casting
26. Discuss the synthesis and application of Teflon
27. Describe the role of initiators and inhibitors in addition polymerisation
28. Distinguish between plastics, elastomers and fibres
29. Describe the TGA of polymers.
30. Discuss the various aspects of molecular recognition involved in the structure ofDNA.
31. Explain kinetics of polymerization and Carothers relation

Section D.

Answer any two questions. Each question carries 15 marks.

32. Discuss the methods of (a) Determining molecular weight (b)Practical significance of molecular weight distribution
33. Write a note on (a) vinyl polymers and (b) discuss about the methods of synthesis of PVA, PVB and Polyacetals.
34. (a) Explain crystallinity in polymers (b) Explain thermal, electrical and mechanical properties of polymers.
35. Write notes on (a) compression (b) moulding (c) casting

B.Sc Chemistry ProgrammeElective Course
2017 admission onwards
Semester-VI Course Code –CH1651.4Credit-2
Total: 54Hrs

BIOCHEMISTRY Module - I Blood 9 Hrs

Constituents of blood cells and plasma, plasma proteins, albumin and globular - lipoproteins, functions (Details not expected), Coagulation - ‘Coagulation factors, Hemoglobin - functions, Structure of hemoglobin, abnormal hemoglobin.

Module II Respiration 9 Hrs

Chemical and physiological events, affecting diffusion of O2 and CO2 during respiration, Transport of Oxygen in Blood O2 dissociation curve, Interrelationship between O2 and CO2 transport.

Module III Kidney Function 9 Hrs

Body water balance, buffers in blood, Formation of Urine, Kidney function, Renal Threshold, Constituents of Urine, diseases associated with Kidney function

Module IV Nutrition 9 Hrs

Measurement of Energy Value of food , Calorific value, caloric requirement, Kilocalorie. Basal metabolic rate (BMR):- Significance, Condition, factors , measurement

Module V Digestion and Absorption of Food 9 Hrs

Outline study of digestion and absorption of Carbohydrates, proteins, fats and enzymes involved , composition and functions of bile - Bile pigments, Bile acids, Bile salts.

Module VI Biochemical Techniques 9 Hrs

Chromatography - Ion exchange, adsorption paper, TLC, GLC, affinity, Gel filtration Electrophoresis - paper, gel, ultracentrifugation.

REFERENCES

1.Gyton,"Text Book of Medical Physiology".

2. Ganog,"Text Book of Medical Physiology ".

3. David Randall, "Physiology".

4. Dr. A.C. Deb, "Fundamentals of Biochemistry".

5. Swaminathan, "Advanced Text Book on Food & Nutrition".

6. B. Srilakshmi, "Nutrition Science".

University of Kerala

B.Sc Chemistry Programme

Model Question Paper

Elective Course Semester VI Course Code CH1651 .4

Biochemistry

2017 admission onwards

Time: 3 hours Maximum marks: 80

Section A.

Answer all questions (maximum two sentences each question carries 1 mark)

1. What is the normal pH of arterial blood?
2. What is the cause of sickle cell anemia?
3. Give an example for plasma protein.
4. What are anticoagulants?
5. Define BMR?
6. What is the renal threshold value of glucose?
7. What is NPN?
8. What is the calorific value of fat?
9. Name the bile pigments.
10. What is GLC?

(10x1=10 marks)

Section B

Answer any eight, each question carries 2 marks

11. Define renal threshold and its significance?
12. What are the normal constituents of urine?
13. What are the different types of hemoglobin?
14. Write a short note on protein digesting enzymes.
15. Draw the structure of heme
16. What are the constituents of blood?
17. What are the functions of plasma protein?
18. What is difference between plasma and serum?

19. What is adsorption chromatograpy?
20. What is the composition of bile?
21. Write about abnormal hemoglobin.
22. Discuss about ion exchange chromatography.

(8 x 2 = 16 marks)

Section C

Answer any six each question each question carries 4 marks

23. Explain Oxygen dissociation curve and factors affecting its shift.
24. Describe gel electrophoresis.
25. Explain thin layer chromatography.
26. Explain briefly the buffers in blood.
27. Give an account of diseases affecting kidney function.
28. Discuss about ultracentrifugation.
29. Discuss the physiological events involved in the transport of oxygen and carbon dioxide.
30. Describe briefly about the various blood cells.
31. Briefly explain about lipoproteins and their functions.

(6 x 4 = 24 marks)

Section D

Answer any two (essay) Each question carries 15 marks 32.

Discuss about (i) Coagulation factors (ii) Anticoagulants (iii) Mechanism of blood clotting. 33. Discuss about the principle procedure and applications of (i) SDS PAGE (ii) Affinity chromatography (iii) Gel filtration chromatography

34. Describe (i) Body water balance (ii) Functions of kidney (iii) Formation of urine.
35. Discuss about the digestion and absorption of (i) Carbohydrate (ii) Protein (iii) Fat

(15 x 2 =30 marks)

UNIVERSITY OF KERALA

SCHEME AND SYLLABUS

(OUTCOME BASED)

FIRST DEGREE PROGRAMME IN CHEMISTRY

(BSc)

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

Core Courses, Foundation Course II, Open and Elective Courses

2020 ADMISSION ONWARDS

UNIVERSITY OF KERALA

SCHEME AND SYLLABUS

FIRST DEGREE PROGRAMME (BSc) IN CHEMISTRY

2020 ADMISSION ONWARDS

The BSc Degree programme in Chemistry covers three academic years of six semesters and aims to provide the students with an in-depth understanding and training in chemical sciences. The syllabus has been designed to stimulate the interest of the students in chemistry and prepared in order to equip the students with a potential to contribute to the academic and industrial requirements of the society. The new, updated syllabus is in accordance with the **OUTCOME BASED EDUCATION (OBE)** which aim at acquiring advanced knowledge in Chemistry as a discipline, in an interdisciplinary way. Based on the new guidelines of OBE, **Programme Outcome (PO)** ***for the First degree Programme is defined by University of Kerala***. **Programme Specific Outcome** relating to BSc Chemistry **(PSO)** and **Course Outcome (CO)** relating to each course are also specified. [CO is of the Remember level(R) understand level(U) and apply level(A) based on Blooms Taxonomy]

Chemistry being an experimental science, due importance is given to the development of laboratory and instrumentation skills. The student is acquainted with the method of science, research methodology and the use of Computational softwares and Cheminformatics thus developing basic skills and knowledge of computing and data based decision making. At the same time, emphasis is given to critically analyse the impact of Chemistry in the present scenario of emerging human friendly and ecofriendly green approach in various facets of life and to become cautious against the random usage of dangerous chemicals.

It also provides a detailed knowledge of the terms, concepts, methods, principles and experimental techniques of chemistry, in order to get a comprehensive knowledge in leading a better life in harmony with nature.

PROGRAMME SPECIFIC OUTCOME (PSO) FOR FDP IN CHEMISTRY

Sl.No.	Upon completion of BSc Degree programme in Chemistry, students	PSO No.
1	Develop scientific outlook scientific attitude and scientific temper	PSO1
2	Develop skill in experimenting , analyzing and interpreting data	PSO2
3	Develop research attitude and adopt scientific method of identifying, analyzing and solving research problems in an innovative way	PSO3
4	Apply physical and mathematical theories and principles in the context of chemical science	PSO4
5	Use chemistry related soft wares for drawing structure and plotting graphs	PSO5
6	Use instruments- potentiometer, conductometer, pH meter and colorimeter.	PSO6
7	Acquire skill in safe handling of chemicals including hazardous materials.	PSO7
8	Identify the ingredients in household chemicals, use them in a critical way	PSO8
9	Predict analytical procedures, compare experimental, theoretical and graphical methods of analysis	PSO9
10	Predict reaction mechanism in organic reactions	PSO10
11	Understand the terms, concepts, methods, principles and experimental techniques of physical, organic, inorganic and analytical chemistry	PSO11
12	Develop critical thinking and adopt healthier attitudes towards individual, community and culture through the course of Chemistry	PSO12
13	Become cautious about environmental aspects and impact of chemicals in soil, water and air and adopt ecofriendly approach in all frontiers of life	PSO13
14	Become responsible in consumption of natural resources and adopt measures for sustainable development.	PSO14
15	Visit Chemical factories and industries with scientific curiosity	PSO15
16	Develop writing skills and presentation skills using audio visual aids	PSO16
17	Compare and share knowledge in an interdisciplinary manner	PSO17
18	Inculcate spirit of originality, novelty, and necessity in scientific research	PSO18
19	Contribute to the academic and industrial requirements of the society	PSO19
20	Get motivated to higher studies - PG Degree in different branches of Chemistry, BEd Degree in Physical Science, and job opportunities in industrial and non industrial sectors	PSO20
21	Adopt safer life skills in a human friendly and ecofriendly way	PSO21

COURSE STRUCTURE

The First Degree programme in Chemistry comprises of fourteen core courses, one project course, two choice based courses (an Open course in V^{th} semester and an Elective course in VI^{th} semester), one core specific foundation course (II^{nd} semester) in addition to one area-specific foundation course, the complementary courses and language courses. The open course offered in the fifth semester is open to students from other Majors. The details of the Course Structure are given in **Table I to VI**.

A Computer Skill Development Programme is included as part of the Core Course-CH1221 (Foundation Course II in Semester II), for computational skill development with no End Semester Evaluation (ESE).

FIRST DEGREE PROGRAMME IN CHEMISTRY

Table I : Course structure, Scheme of Instruction and Evaluation

SEMESTER I								
Course Code	Study component	Instructional hrs/Week		Credit	Duration of Uty. Exam	Evaluation marks		Total Credit
		T	P			CE	ESE	18
EN1111	English I	5		4	3hrs	20	80	
1111	Additional Language I	4		3	3hrs	20	80	
EN1121	Foundation Course I	4		2	3hrs	20	80	
MM1131.2	Complementary Course I	4		3	3hrs	20	80	
PY1131.2	Complementary Course II	2		2	3hrs	20	80	
	Complementary Course Lab of PY1131.2		2	-	-	-	-	
CH1141	Core Course I	2		4	3hrs	20	80	
	Core Course Lab I of CH1141		2	-	-	-	-	
SEMESTER II								
EN1211	English II	4		3	3hrs	20	80	18
EN1212	English III	5		4	3hrs	20	80	
1211	Additional Language II	4		3	3hrs	20	80	
CH1221	Foundation Course II	2	2	3	3hrs	20	80	
MM1231.2	Complementary Course III	4		3	3hrs	20	80	
PY1231.2	Complementary Course IV	2		2	3hrs	20	80	
	Complementary Course Lab of PY1231.2		2	-	-	-	-	

SEMESTER III								
EN1311	English IV	5		4	3hrs	20	80	18
1311	Additional Language III	5		4	3hrs	20	80	
MM1331.2	Complementary Course V	5		4	3hrs	20	80	
PY1331.2	Complementary Course VI	3		3	3hrs	20	80	
	Complementary Course Lab of PY1331.2		2	-	-	-	-	
CH1341	Core Course II	3		3	3hrs	20	80	
	Core Course Lab I of CH1341		2	-	-	-	-	
SEMESTER IV								
EN1411	English V	5		4	3hrs	20	80	24
1411	Additional Language IV	5		4	3hrs	20	80	
MM1431.2	Complementary Course VII	5		4	3hrs	20	80	
PY1431.2	Complementary Course VIII	3	2	3	3hrs	20	80	
	Complementary Course Lab of PY1131.2 PY1231.2 PY1331.2 & PY1331.2			4	3hrs	20	80	
CH1441	Core Course III	3		3	3hrs	20	80	
CH1442	Core Course IV- Lab I of CH1141		2	2	3hrs	20	80	
SEMESTER V								
CH1541	Core Course V	3		4	3hrs	20	80	19
CH1542	Core Course VI	4		4	3hrs	20	80	
CH1543	Core Course VII	4		4	3hrs	20	80	
CH1544	Core Course VIII Lab II		5	3	6hrs	20	80	
CH 1545	Core CourseIX Lab III		4	2		20	80	
1551	Open Course	3		2	3hrs	20	80	
	Project		2	-	-	-	-	
SEMESTER VI								
CH1641	Core Course X	3		4	3hrs	20	80	23
CH1642	Core Course XI	4		4	3hrs	20	80	
CH1643	Core Course XII	4		4	3hrs	20	80	
CH1644	Core Course XIII Lab IV			3	6hrs	20	80	
CH1645	Core Course XIV Lab V			2		20	80	
CH1661.1/ CH1661.2/ CH1661.3/ CH1661.4	Elective Course	3		2	3hrs	20	80	
CH1646	Project and Factory Visit		3	4	Viva voce	-	100	

CE -Continuous Evaluation, ESE- End Semester Evaluation

Table I A. Total number of Courses offered in BSc programme

Sl No.	Courses	No. of courses	Credits semester wise
1	Language Courses	9	7+10+8+8=33
2	Foundation Courses	2	2+3=5
3	Complementary Courses	9	5+5+7+11=28
4	Core Courses	14	4+3+5+17+17=46
5	Open Course	1	2
6	Elective Course	1	2
7	Project	1	4
Total number of Courses		37	
Total number of credits in all six semesters		18+18+18+24+19+23=120.	120

Table II.Scheme of instruction of Core Courses, Foundation Course II, Open Course and Elective Course

Course No. Course code	Course Title	Sem I		Sem II		Sem III		Sem IV		SemV		Sem VI		Total	
		Hrs L/P	C	Hrs L/P	C	Hrs L/P	C	Hrs L/P	C	Hrs L/P	C	Hrs L/P	C	Hrs	**C**
C.C.I CH1141	Inorganic Chemistry I	2/2	4											2	**4**
F.C.II CH1221	Chemistry-its Origin, Methodology and Impacts			2/2	3									4	**3**
C.C.II CH1341	Inorganic Chemistry II					3/--	3								**3**
C.C.III CH1441	Organic Chemistry I														**3**
C.C.IV CH1442	Lab I of CH1141,CH1341&CH14 41 (Inorganic Qualitative Analysis)					--/2		--/2	2					6	**2**
C.C.V CH1541	Physical Chemistry I									3/--	4			3	**4**
C.C.VI CH1542	Inorganic Chemistry III									4/--	4			4	**4**
C.C.VII CH1543	Organic Chemistry II									4/--	4			4	**4**
C.C.VIII CH1544	Lab II of CH1541,CH1542&CH15 43 (Inorganic Volumetric Analysis)									--/5	3			5	**3**
C.C.IX CH1545	Lab III of CH1541,CH1542&CH15 43 (Physical Chemistry Experiments)									--/4	2			4	**2**
O.C CH1551	Open to other majors									3/--	2			3	**2**
C.C.X CH1641	Physical Chemistry II											3/--	4	3	**4**

C.CXI CH1642	Organic Chemistry III											4/--	4	4	**4**
C.CXII CH1643	Physical Chemistry III											4/--	4	4	**4**
C.C.XIII CH1644	Lab Course IV (Organic Chemistry Experiments)											--/5	3	5	**3**
C.C.XIV CH1645	Lab Course V (Gravimetric Experiments)											--/3	2	3	**2**
E.C CH1661	Any one of the options											3/--	2	3	**2**
C.C.XV CH1646	Project									--/2		--/3	4	5	**4**
	Factory visit														
Credits/Semester		**4**		**3**		**3**		**5**		**19**		**23**			**57**

C.C-Core Course, F.C-Foundation Course, O.C-Open Course, E.C-Elective Course
L-Theory, P-Practical, C-Credit

B.Sc. Degree Programme in Chemistry
Table III. Open Course offered to students of other disciplines
Semester V

Semester	No. of Hours / Week		Credits	Course Code	Title of the Course	Instructional Hours
	L	P				
V	3	-	2	CH1551.1	Chemistry and its Application	54
				CH 1551.2	Fundamentals of Chemistry & Its Application to Everyday Life	
				CH 1551.3	Environmental Chemistry	

B.Sc. Degree Programme in Chemistry
Table IV. Elective Course offered in Semester VI

Semester	No. of Hours / Week		Credits	Course Code	Title of the Course	Instructional Hours
	L	P				
VI	3	-	2	CH1661.1	Supramolecular, Nano Particles and Green Chemistry	54
				CH 1661.2	Computational, Combinatorial and Physical Organic Chemistry	
				CH 1661.3	Polymer chemistry	
				CH 1661.4	Biochemistry	

Table V. Complementary Courses offered to BSc Chemistry (One Semester 18 weeks)

(Complementary programme - Mathematics, Total Credits – 14)

Semester	Hours/week	Number of Credits	Course code	Instructional Hours
I	4	3	MM1131.2	4×18 = 72
II	4	3	MM1231.2	4×18 = 72
III	5	4	MM1331.2	5×18 = 90
IV	5	4	MM1431.2	5×18 =90

Table VI. Complementary Courses offered to BSc Chemistry (One Semester 18 weeks)

Complementary Programme- Physics , Total Credits – 14

Semester	Hours/Week		Number of Credits	Course code	Instructional Hours
	L	P			
I	2	2	2	PY1131.2	2×18 = 36 2×18 = 36
II	2	2	2	PY1231.2	2×18 = 36 2×18 = 36
III	3	2	3	PY1331.2	3×18 = 54 2×18 = 36
IV	3	2	3 4	PY1431.2 PY1432.2	3×18 =54 2×18 = 36

GENERAL ASPECTS OF EVALUATION

MODE OF EVALUATION - COMMON TO CORE, ELECTIVE, COMPLEMENTARY AND FOUNDATION COURSES

Evaluation of each course shall involve Continuous Evaluation (CE) of 20 marks and End Semester Evaluation (ESE) of 80 marks.

1. CONTINUOUS EVALUATION FOR LECTURE COURSES

The Continuous evaluation will have 20 marks and will be done continuously during the semester.

CE components are

(i) Attendance for lecture and laboratory sessions (to be noted separately where both lecture and laboratory hours have been specified within a course);

(ii) Assignment /seminar and

(ii) Test

The distribution of marks is shown below. There will be two class tests for which, the better of the two marks obtained will form part of CE. Seminar for each course to be organized by the course teacher and assessed along with a group of teachers in the Department. The topic selection by the student for assignments/seminar will be with the approval of the course teacher.

No	Component	Marks
1	Attendance	5
2	Assignment / Seminar	5
3	Tests	10
	Total	**20**

1.1. EVALUATION OF THE ASSIGNMENTS AND SEMINAR

The topic selection by the student for assignments/seminar will be with the approval of the course teacher.

The assignment can be

1. A report of about 4-6 pages in A4 size paper
2. The topic can be presented either as oral or as power point for 10 minutes duration using audio-visual aids if available. The seminar is to be conducted within the contact hour allotted for the course.
3. Preparing Charts on assigned topic
4. Making static or working models.

The submitted report /chart /models should be evaluated for assignment marks.

Mode of Assignments / Seminar Evaluation		
No	**Main Component**	**Marks**
1	Adherence to overall structure & submission deadline	All four main components present & satisfactory : 5 Only three : 4 Only two : 3 Only one : 2
2	Content & grasp of the topic	
3	Lucidity / Clarity of presentation	
4	References / Interaction/Overall effort	

1.2 QUESTION PAPER PATTERN FOR CONTINUOUS EVALUATION TESTS

- The theory examination has a duration of 1.5 hours and a maximum mark of 40
- Questions should be 20% hard, 60% medium and 20% easy.

1. Each question paper has three sections: A, B & C
2. Section A has ten compulsory- one word/one sentence questions carrying 1 mark each .
3. Section B contains twelve short questions of which 7 questions have to be answered. Each question carries 2 marks.
4. Section C contains nine questions of which 4 has to be answered. Each question carries 4 marks.
   The answer must contain at least 8 points (Short Essay type).
5. 30% of the questions in physical chemistry papers should be problem based.

Question Paper Pattern for CE Test		
Question No	Type of Question	Marks
Section A: 1-10	All / one word/one sentence	1X10=10
Section B: 11-22	7out of 12; Short Answer	7 X2=14
Section C: 23-31	4 out of 9; Short Essay	4 X4= 16

TOTAL	40 marks

DETAILS OF ESE FOR LAB COURSES					
Lab Course	Course name	ESE	Time	Total Marks 100	
				CE	ESE
Lab course I	Inorganic Qualitative analysis	IV Semester	3Hrs	20	80
Lab course II	Inorganic Volumetric analysis	V Semester	3Hrs	20	80
Lab course III	Physical chemistry experiments	V Semester	3Hrs	20	80
Lab course IV	Organic Chemistry Experiments	VI Semester	3Hrs	20	80
Lab course V	Gravimetric Experiments	VI Semester	3Hrs	20	80

1.3 CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation will have 20 marks. The ESE of inorganic qualitative analysis will be done only in the IV semester and similarly the ESE of physical chemistry experiments and volumetric analysis will be done only in the V semester. The ESE of Organic and Gravimetric experiments will be done at the end of VI semester.But the corresponding CE are calculated from all the semesters in which there is attendance for laboratory sessions.

No	Component	Marks
1	Attendance	5
2	Lab test	5
3	Record	5
4	Punctuality	5
Total		**20**

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1.4 EVALUATION OF THE RECORD

On completion of each experiment, a report should be presented to the course teacher as soon as the experiment is over. It should be recorded in a bound note-book. The experimental description should include aim, principle, materials/apparatus required/used, method/procedures, and tables of data collected, equations, calculations, graphs, and other diagrams and the final results.

CE for Lab report &Laboratory Record *		
No	**Sub Component**	**Marks**
1	Punctual submission and Neat presentation	All four sub-components present & satisfactory : 5
2	Record of more than 90% experiments in the syllabus	Any three : 4 marks
3	Calculations and absence of errors/mistakes	Only two : 3
4	Accuracy of the result	Only one : 2

***The LAB RECORD of experiments, certified by the tutor and HOD is compulsory for the ESE**

2. GUIDELINES FOR QUESTION PAPER SETTERS FOR ESE

- The theory examination has a duration of 3 hours
- The maximum marks is 80 for each theory paper.
- Question paper should contain 20% Remember (R) ,60% Understanding (U) and 20% Application (A) Level questions.
- Questions should be as per the syllabus from the standard text books mentioned in syllabus
- Question paper setter should submit a detailed scheme of evaluation along with question paper.

QUESTION PAPER PATTERN (ESE)

1. Each question paper has four Sections: A, B , C and D
2. Section A has ten compulsory- one word/one sentence questions carrying **1** mark each .
3. Section B contains twelve short questions of which eight questions have to be answered. Each question carries **2** marks with four points (Short Answer type).
4. Section C contains nine questions of which six has to be answered. Each question carries **4** marks. The answer must contain at least 8 points (Short Essay type).
5. Section D contains four questions of which the candidate has to answer two. Each question should have **three subdivisions** with a total of **15** marks.

Question Paper Pattern for ESE		
Question No	Type of Question	Marks
Section A: 1-10	10 one word/one sentence	1x10=10
Section B: 11-22	8 out of 12; Short Answer	2x8=16
Section C: 23-31	6 out of 9; Short Essay	4x6=24
Section D: 32-35	2 out of 4	15x2=30
Total		**80 marks**

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards

Semester	I
Course	Core course-I
Course name	**INORGANIC CHEMISTRY I**
Course Code	CH 1141
Credit	2
Hours	36 hours
Lecture-Tutorial-Lab	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**	**PSO No.**
1	Discuss the course of development of structure of atom.	U	PSO1
2	Apply rules for filling electrons in classifying elements into s, p,d and f blocks	A	PSO10
3	Define various scales of electronegativities and their applications	U	PSO10
4.	Define Effective nuclear charge and Slater's rules	U,A	PSO10
5	Discuss about diagonal relationship and anomalous behaviour of hydrogen and other first element in each group.	U	PSO4
6	Correlate and predict general properties of s and p block elements based on their electronic configuration.	A	PSO4
7	Realise applications of s and p block elements in sustainable and renewable energy sources.	A	PSO14
8	Define various concepts of acids and bases.	U	PSO11
9	Understand reactions in non aqueous solvents.	U	PSO11
10	Realise various causes, effects and control measures of environmental pollution.	E	PSO13
11	Review national movements for environmental protection.	U, A	PSO21

MODULE	**COURSE DESCRIPTION**	**Hrs**	**CO No.**
1	**Atomic Structure and Periodicity**	**9**	
1.1	Introduction to structure of atom, Rutherford and Bohr model of atom,	1	1
1.2	Dual nature of electron-de Broglie equation-matterwaves and electromagnetic waves. Experimental verification by Davis and Germer method,Heisenberg's uncertainty principle- expression and significance.	1	1
1.3	Wave mechanical concept of the atom-Schrodinger	1	1

	equation and its significance (derivation not required.)		
1.4	Quantum numbers- Pauli's Exclusion principle- Aufbau Principle- Hund's rule- Electronic configuration of atoms- classification of elements into s,p,d and f blocks-	2	1
1.5	Electronegativity- Pauling's scale, Mulliken and Allred-Rochow scale(including numerical problems),	2	4
1.6	Effective nuclear charge, Slaters rule and its applications, diagonal relationship and anomalous behavior of first element with other elements.	2	4,5
2	**Representative elements**	**9**	
2.1	General properties of s and p block elements, Hydrogen – isotopes and its applications- uses as a fuel, water gas	2	6
2.2	Physical properties- atomic radii, ionization enthalpy, electron negativity, electron affinity, Flame colouration, inert pair effect	2	6
2.3	Chemical properties- solubility and thermal stability of alkali and alkaline earth metal oxides, sulphates and hydrides	2	6
2.4	p-block elements- oxides of nitrogen and phosphorus, oxyacids of halogens	1	6
2.5	Allotropism – carbon, sulphur and phosphorus	1	6
2.6	Applications- lithium battery, cesium in photovoltaic cells, selenium in xerography and barium x-ray	1	7
3	**Acids, Bases and non- aqueous solvents**	**9**	
3.1	Arrhenius concept, Lowery –Bronsted, Lewis concepts and Lux Flood concept and its limitations,	2	8
3.2	SHAB principle and its applications,	1	8
3.3	Non – aqueous solvents: General properties- classifications- self ionization and leveling effect-	2	9
3.4	Reaction in non-aqueous solvents- protic and aprotic non-aqueous solvents- examples-solutions of metal s in liquid ammonia- self ionization of liquid ammonia-liquid SO_2, liquid HF, alkali metals in liquid ammonia.	4	9
4	**Environmental chemistry- Air, water and soil pollution**	**9**	
4.1	Air pollution- Air pollution caused by fire works, harmful effects of fire works, acid rain, green house effect, smog- classic and photochemical smog	2	10

	Ozone layer depletion, ozone hole, protection of ozone umbrella. Management of air pollution.		
4.2	Water pollution: causes- heat, industrial waste, sewage water, detergents, agricultural pollutants Treatment of industrial waste water- Activated charcoal, synthetic resins, reverse osmosis and electro dialysis Quality of drinking water- Indian Standard and WHO standard- Dissolved oxygen- BOD , COD.	3	10
4.3	Soil pollution: pesticides, fertilizers, Industrial waste, Plastic. Control of Plastic threat- importance of Plastic identification codes and Plastic recycling, use of biodegradable plastics (PGA,PLA and PHBV(mention only)	2	10
4.3	Control of pollution. Pollution Control Board – Duties and responsibilities Mention environmental movements (Plachimada,Silent valley, movement against Endosulfan, Narmada Bachavo Andolan and Chipko movement)	2	11

Text Books

1. B.R.Puri, L.R,.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers New Delhi,2010
2. F.A.Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley, India(P)Ltd
3. J.D.Lee, Concise Inorganic Chemistry,5thEdn. Wiley, India(P)Ltd.
4. A.K.De,Environmental Chemistry,New Age International(P) Ltd. New Delhi
5. A.K.Ahluwalia, Environmental Chemistry, Ane Books, India, New Delhi.

For Further Reading

1. M.C.Day and J Selbin, Theoretical Inorganic Chemistry,2nd Edn.,Reinhold Book Corp.
2. S.Prakash,G.D.Tuli, S.K Basu, R.D.Madan,Advanced Inorganic Chemistry, Vol. 1.,S Chand
3. J.E.Huheey,E.A.Keiter, R.L.Keiter, O.K.Medhi. Inorganic Chemistry, 4th Edn. Pearson, 2006
4. S.S.Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edn. S Chand& Sons, New Delhi.
5. M.N.Greenwood, A .earnshaw, Chemistry of the Elements, 2nd Edn. Butterworth, 1997.

UNIVERSITY OF KRALA
Model Question Paper of B.Sc. Chemistry First Degree Programme

2020 Admission onwards
SEMESTER -I Core Course-1 Course Code - CH1141 Credit-4

INORGANIC CHEMISTRY I

Time: 3 Hours **Maximum Marks: 80**

SECTION A

(Answer **all** questions in one word/one sentence. Each question carries **1** mark)

1. Mention about the flame colouration of II group elements.
2. Write an example of classic smog.
3. State Heisenberg's uncertainty principle.
4. What are matter waves?
5. Which is the conjugate base of HF.
6. Define covalent radius.
7. Write the reason for eutrophication.
8. In the stratosphere, fluorine from the CFC's change to which compound.
9. Name the radio isotope of hydrogen?
10. Mention any one use of alkali metals. **(1 X 10 = 10marks)**

SECTION B

(Answer any **8** questions. Each question carries **2** Marks)

11. Calculate the wavelength of electron moving with a velocity of 10^6 ms^{-1}.
12. A cricket ball weighing 100g is to be located within 0.1A^o. What is the uncertainty in its velocity?
13. What are eigen values and eigen functions?
14. How first element differs from other elements in a group?
15. What is COD?
16. What are ortho and para hydrogens.
17. Write SHAB principle?
18. Comment about the hydration of alkali metals?

19. State and illustrate Pauli's Exclusion Principle.

20. Distinguish between levelling solvents and differentiating solvents.

21. Write a note on green house effect.

22. What is acid rain? **(2 X 8 = 16marks)**

SECTION C

(Answer any **6** questions. Each question carries **4**Marks)

23. Discuss the following reactions in liquid SO_2.
    (i) Solvation (ii) acid- base reaction

24. Discuss hydrogen and water gas as fuels.

25. Describe reverse osmosis for water purification.

26. Briefly explain about the Davisson and Germer's experimental verification of wave nature of electron.

27. What is smog? What are the different types of smog?

28. How ozone layer is depleted?

29. What is the trend of Ionization enthalpy and electron gain enthalpy in the periodic table?

30. What are hydrides? Explain.

31. Discuss about the redox property of alkali metals

(4 X 6 = 24marks)

SECTION D

(Answer any **2** questions. Each question carries **15** Marks)

32. (a) What is effective nuclear charge? Explain with example.
    (b) Write a note on various electronegativity scales
    (c) Explain about the various rules for filling up of electrons in orbitals. (5+5+5 Marks)

33. (a) Write a note on allotropes of carbon.
    (b) Discuss on the topic 'hydrogen as next generation fuel'
    (c) Give an account of Cesium in photo voltaic cell and Lithium battery (5+5+5 Marks)

34. (a) What are the common characteristics of solvents?

(b) Liquid ammonia is a better solvent for organic compounds. Why?

(c) Write a note on various concepts of acids and bases. (5+5+5 Marks)

35 .(a) Briefly discuss about the various air pollutants

(b) Fertilizers and pesticides pollute soil. Justify.

(c) Explain about the various water quality parameters (5+5+5 Marks)

(15 X 2 = 30marks)

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME
2020 admission onwards

Semester	II
Course	Foundation course II
Course name	**CHEMISTRY –ITS ORIGIN, METHODOLOGY AND IMPACTS**
Course Code	CH 1221
Credit	2
Hours	36 hours
Lecture-Tutorial-Lab	2-0-2

CO no.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive level**	**PSO**
1	Appreciate the development of scientific theories through years with specific examples	U	PSO1
2	Develop curiosity and scientific attitude towards the application of chemistry in daily life	C	PSO1
3	Outline a procedure for experimentation	A	PSO2
4	Appraise the current development in Chemistry	E	PSO1
5	Identify the common ingredients of house hold synthetic products	U	PSO8
6	Discriminate and classify chemicals used as drugs,explosives,	U	PSO7
7	Get motivated in visiting chemical Industries	E	PSO15

8	Adopt safety measures in handling chemicals	A	
9	Draw titration curves and explain theory of volumetric titrations	A	PSO2/PSO3
10	Select suitable indicators for acid base titration knowing the theories of acid base titration and indicators	A	PSO11
11	Develop computational skills	A	PSO5
12	Discuss separation techniques of filtration and chromatographic techniques	U	PSO3

R-Remember, U-Understand, A-Apply

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Evolution of Chemistry as a discipline of science**	**3**	
1.1	Evolution of Chemistry - ancient speculations on the nature of matter, early form of chemistry-alchemy.	1	1
1.2	Major contributions of Friedrich Wöhler, Mendeleev, Michael Faraday and Marie Skłodowska-Curie	1	2
1.3	Scope of Chemical Science, branches of Chemistry Basic idea of Chemistry as a central science connecting Physics , Biology and other branches of science	1	2
2	**Impact of Chemistry in human life**	**9**	
2.1	**Food Chemistry**: Food additives, preservatives, anti oxidants, commonly used permitted and nonpermitted food colours artificial sweeteners-taste enhancers, Health effects of fast foods, instant foods, dehydrated foods and junk foods, 'trans fat'	2	2
2.2	**Cleansing agents:** Soaps- Hard and soft soaps, alkali content-TFM, Detergents , Shampoos (Common ingredients and health aspects) **Cosmetics**: talcum powder, lip sticks, nail polish, moisturiser , hair dye, Sun screen lotions(Common ingredients and health aspects)	1	5,6,7
2.3	**Role of Chemistry in sustainable development** Role of chemical industries in polluting the environment, limitations of conventional waste management, birth of green chemistry	2	2
2.4	**Solar energy harvesting** :	1	2

	Photosynthesis, Photovoltaic cell, conventional solar cells, nano structured solar cells		
2.5	**Green solvents:**safer solvents - water, Super Critical fluids(CO_2), ionic liquids, advantages of SCF	1	2
2.6	**Chemistry in the field of Medicine** (Elementary idea only) Radio active tracers in diagnosis and treatment of cancer: use of Radio isotopes(^{60}Co, ^{131}I) Use of MRI scanning, Dialysis in blood purification. advantages and disadvantages in using these techniques	2	6
3	**Methods and Tools of Science & Research methodology**	**6**	
3.1	Basis for scientific laws and factual truths– hypothesis observations- experimental proofs. Theories and laws	1	1
3.2	Experimentation - Design of an experiment, data collection – types of data -interpretation and deduction –repeatability and replication- Accuracy and precision, Revision or modification of scientific theories and laws	1	3
3.3	Research methodology, scientific method of conducting research: Selecting and defining a problem, Science Journals, Impact factor, citation, ISSN, ISBN.	1	4
3.4	*Educational softwares – INFLIBNET, NICNET, BRNET, NPTEL, VIRTUAL LABS OF MHRD academic services *Chemistry related softwares-Chem sketch and Chem Draw for structure drawing, *Chemical Databases-Pubchem, ZINC, Cambridge Structural Database (CSD), *Molecular visualization tools –Avogadro, Molden, Molekel, *File format-PDB and CIF *Graphical tools- Excel and Origin (*elementary idea only with computer assistance). .	2	11
3.5	Study of the latest/current Nobel prize winners in chemistry	1	4

4	**Analytical Principles and techniques**	**9**	
4.1	Inorganic qualitative analysis –Common ion effect and solubility product and their application in the precipitation of cations in a mixture. Introduction of Microscale analysis as a green chemistry approach	2	3
4.2	Quantitative Analysis:Theory of acid-base titration - titration curve of strong acid-strong base ,weak acid – strong base, strong acid- weak base and weak acid- weak base, theory of acid-base indicators	2	10
4.3	Theory of Redox titration: Titration of Fe^{2+} with $KMnO_4$ and $K_2Cr_2O_7$ and theory of redox indicators	1	10
4.4	Theory of complexometric titration: metal ion-EDTA titration. Theory of metallochromic indicators Precipitation titration: NaCl- AgNO3 titration and use of potassium chromate as adsorption indicator	1	10
4.5	Chromatography - classification of methods - Elementary study of adsorption chromatography Column and thin layer- partition chromatography-paper- ion exchange and gas chromatographic methods	1	12
4.6	Gravimetric Analysis - Mechanism of precipitate formation - Factors affecting solubility of precipitates – co-precipitation and post precipitation - Effect of digestion - washing, drying and ignition of precipitates.	2	3
5	**Chemistry and industry**	**3**	
5.1	Cement: Introduction, types of cement , manufacture, chemical composition of Portland cement, setting and hardening of cement and special cement	1	6,7
5.2	Ceramics: Introduction, types of clay products, properties of clay, plasticity of clay, manufacturing of white wares and stone wares and their application	1	6,7
5.3	Paints: Primary constituents, binders and solvents, requirements of a good paint-oil based paints, latex paints, luminescent paints, fire retardant paints and heat resistant paints Pigments**:** definition, White lead, lithopone, ultramarine, red lead, Guignet's green and chrome yellow	1	6,7
6	**Lab Safety measures and disaster management**	**6**	
6.1	Introduction to lab safety-regulatory requirements-labels,	1	5,8

	material safety. Knowledge of hazard warning information and symbols.		
6.2	Propellants and Explosive compounds ,Examples- TNT,TNG,Urea nitrate,Hydrazine derivatives. potentially dangerous mixtures- Flammable solvents, ignition sources used in laboratories, metal hydrides(basic idea)	2	2
6.3	Reactive inorganic substances and their toxicity (strong acids, bases, halogens, chromates). Hazards due to chemicals, toxic-solids, liquids, gases, and other harmful substances - carcinogenic substances.	2	2
6.4	Emergency procedures in chemical splashes to skin and eyes, burns and electric shock.	1	8

Textbooks

1 N.C. Datta, "The Story of Chemistry" , University Press.
2. B K Sharma, Industrial chemistry, 11th edition, Goel Publishing House, Meerut, 2000
3. B Srilakshmi, Food Science,5th edition, New Age Publishers, NewDelhi,2010
4.Kirpal Singh, Chemistry in Daily Life, PHI Learning Pvt.Ltd, 201
5. Muhammed Musa, Gaji, Abhishek Varma,(Editors)"Development of Solar power generation and energy harvesting", **ISBN 9789351249498**, Publisher Astral
6. Medicinal Chemistry , An introduction, II nd edition Gareth Thomas, Wiley
7. Hazards in chemical laboratories and guide to safe practices in chemical laboratories published by Royal Society of Chemistry
8. A. I. Vogel, "Text book of Quantitative Inorganic Analysis
9. Day& Underwood "Quantitative analysis: laboratory manual

Further reading

1. H.Collins and T.Pinch ,The Golem : What everyone should know about science, Cambridge Univ Press 1993
2.R T Mishra, Teaching of information Technology.
3.M Ravikumar, Information Technology for Higher Education
4.Fletcher,Gilbert , Radiation therapy in the management of cancers;
5.http://www.vlab.co.in
6.http://nptel.iitm.ac.in/
7. V. Rajaram, Introduction to Information Technology , Prentice Hall

8. Barbara Wilson, Information Technology, The Basics, Thomas Learning
9.Calvin W Tayler and Frank Barron Scientific Creativity : Its Recognition and Development

10. A.H Ahluwalia,Renu Aggarwal, Comprehensive Practical organic chemistry Renu Aggarwal, 2000, Universities press.
11.T.F.Gieryn, Cultural boundaries of science Univ. Chicago Press 1999
12.MSR Winter, A Consumer's dictionary of cosmetic ingredients, 7th edition, Three Rivers Press, NewYork,2009

UNIVERSITY OF KERALA

Model Question Paper of B.Sc. Chemistry Programme
2020 Admission onwards
SEMESTER –II Course Code - CH 1221
Foundation course II
CHEMISTRY-ITS ORIGIN, METHODOLOGY AND IMPACTS

Time: 3 Hours **Maximum Marks: 80**

SECTION A

Answer all Questions in one word to maximum of two sentences

Each question carries one mark

1. Name two interdisciplinary branches of chemistry.
2. State and explain the term alchemy.
3. Define the term repeatability.
4. Define hypothesis.
5. Name a redox indicator?
6. Define Rf value
7. Name an artificial sweetener.
8. Write one example ionic liquid.
9. Draw two symbols for hazardous chemicals.
10. What are propellants?

10x1 = 10 marks

SECTION B

Short answer type (Not to exceed one paragraph)

Answer any 8 questions from the following.

Each question carries two marks

11. Write any two contributions by the scientist Marie Curie?
12. Name any two databases and molecular visualization tools in chemistry?
13. State the difference between accuracy and precision.
14. Write the importance of ISSN and ISBN.
15. How micro scale analysis support green chemistry?
16. What are metallochromic indicators?
17. What are the errors occurring in gravimetric analysis?
18. Explain two educational softwares.
19. What are food additives?
20. How solar energy is trapped naturally?
21. What do you mean by' trans fat'?
22. Write short note on ceramics.

8×2 = 16 marks

SECTION C

Short essay (Not to exceed 120 words**)**
Answer any 6 questions from the following.
Each question carries four marks

23. What are soaps. How are they classified? Discuss the parameters to check the quality of soap.
24. Write a note on research methodology.
25. How will you plot a standard curve using excel sheet?
26. Describe the theory behind redox titration with one example?
27. Explain the different steps in gravimetric analysis?
28. Write a short note on the contributions of latest Nobel laureates in chemistry.
29. Briefly explain 1) MRI, 2) dialysis
30. Discuss the importance of plastic recycling in the present scenario.
31. Discuss the principle of paper chromatography.

6× 4 = 24 marks

SECTION D

Answer any two questions from the following
Each question carries fifteen marks

32. a. Discuss on green solvents.
    b. Write the importance of research journals?
    c).What are the major contributions of Faraday, Medeleeve and Wohler in chemistry? (5+5+5)
33. a)Discuss the application common ion effect in the inter group separation of cations.
    b)Describe the manufacture of cement and the chemistry of setting.
    c)Differentiate between propellants and explosives. Give examples (5+5+5)

34. a) Discuss on paints, classification and constitution.
b)Write note on white lead, lithopone and ultramarine
c)Explain the different methods of harvesting solar energy (5+5+5)

35.Explain the safety measures to be adopted in the laboratory?

b)Briefly discuss on microscale analysis as a green chemistry approach.
c)Discuss on metal ion EDTA complexation and its application (5+5+5)

2×15 = 30 marks

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	III
Course	Core course-II
Course name	**INORGANIC CHEMISTRY II**
Course Code	CH 1341
Credit	3
Hours	54 hours
Lecture-Tutorial-Lab	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students.*	Cognitive Level	PSO No.
1	Understand various theories of chemical bonding and their limitations.	U	PSO4
2	Predict stability of atoms and the nature of bonding between atoms.	U,A	PSO4
3	Discuss various applications of intermolecular interactions	U	PSO4
4.	Understand chemistry of glass, silicates and silicones	U	PSO7 PSO8
5	Discuss chemistry of Boron compounds, oxyacids and oxides of Phosphorous	U	PSO11
6	Understand refractory carbides, nitrides, borides and silicides.	U	PSO11
7	Describe various types of halogen compounds.	U	PSO3
8	Understand chemistry of noble gas	U	PSO3
9	Understand inorganic polymers and their applications.	U	PSO8
10	Distinguish between types of nuclear reactions.	U	PSO11
11	Describe measurement of radioactivity.	U	PSO2 PSO3
12	Discuss applications of radioactivity in various fields.	U	PSO3
13	Understand introductory concepts of nanochemistry	U,A	PSO18
14	Suggest methods of synthesizing nano materials.	U	PSO18
15	Appreciate the variety of applications of nanomaterials.	U ,A	PSO18

R-Remember, U-Understand, A-Apply

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Chemical Bonding I**	**9**	
1.1	VSEPR theory and its applications- structure of molecules with bond pairs only, molecules with both bond pairs and lone pairs-	3	1
1.2	valence bond theory- conditions of overlapping- types of overlapping(positive , negative and zero overlapping), hybridization-methane, ethylene, benzene,acetylene, allenes, sp^3d and sp^3d^2- limitations of VBT.	3	1
1.3	MO theory, LCAO, homonuclear diatomic molecules- C_2, B_2, N_2, O_2 and ions like O_2^+ - heteronuclear diatomic molecules(HF, NO and CO)-calculations of bond order and its applications.	3	1
2	**Chemical Bonding II**	**9**	
2.1	Types of bonding- ionic bond- ionic lattice energy of ionic compounds- Bond –Lande equation, Born – Haber cycle, salvation energy and solubility of ionic solids, covalent character of ionic bond, Fajan's rules	2	2
2.2	Polarity of covalent bond- dipole moment- percentage of ionic character- dipole moment and molecular structure.	2	2
2.3	Metallic bonding- free energy theory, VB theory and band theory (Qualitative treatment only) –	1	2
2.4	Secondary forces- hydrogen bond, inter and intramolecular hydrogen bond, Applications-intermolecular interactions- ion-dipole-van der Waal's forces such as dispersion forces, dipole-dipole, ion – induced dipole, dipole induced dipole.	4	2, 3
3	**Compounds of non- transition elements I**	**9**	
3.1	Manufacture and uses of the following Glass- different types of glasses, silicates, zeolites and silicones.	4	4
3.2	Borax- boron hydrides, boron nitrides, borazole and carboranes,	2	5
3.3	Oxides and oxyacids of phosphorus.	1	6
3.4	Refractory carbides, nitrides, salt like carbides, borides and silicides.	2	7
4	**Compounds of non- transition elements II**	**9**	
4.1	Oxides and oxyacids of halogens (structure only) – inter halogen compounds and pseudo halogens-	3	8
4.2	Noble gases-uses, Xenon compounds–structure and hybridization in Xenon fluorides.	2	9
4.3	Inorganic polymers, phosphorus, boron and silicon based polymers- structure and industrial applications.	4	10
5	**Nuclear chemistry** (numerical problems expected)	**9**	
5.1	Natural radioactivity, decay constant (Derivation not expected), half life, average life	1	11
5.2	Disintegration series, modes of decay-α,β, positron emission and electron capture, artificial transmutation and artificial radioactivity	1	11
5.3	Nuclear stability, n/p ratio,modes of decay- α, β and positron emission, packing fraction, mass defect and binding energy	1	11

5.4	Units of radio activity, Measurement of radioactivity by GM counter, Wilson cloud Chamber, scintillation counter,	1	12
5.5	Nuclear fission-atom bomb and nuclear fusion- hydrogen bomb-	1	13
5.6	Applications of radioactivity- ^{14}C dating, rock dating, neutron activation analysis Isotope as tracers, dosimetry, units Study of reaction mechanism (ester hydrolysis)	2	13
5.7	Application of radioactive isotope in medicine- radio diagnosis and radiotherapy, industrial applications	1	13
5.8	Merits and demerits of nuclear technology.	1	13
6	**Chemistry of Nano materials**	**9**	
6.1	Evolution of nanoscience- Historical aspects, preparations containing nano gold in traditional medicine. Lycurgus cup-Faraday's divided metal etc. Nanosystems in nature.	2	14
6.2	Preparations of nanoparticles: Top-down approaches and Bottom to top approaches. Sol- gel synthesis, colloidal precipitation, co-precipitation, combustion techniques, sonochemistry, hydrothermal technique, high energy ball milling etc.	3	13
6.3	Carbon nanotubes , fullerens.	1	14
6.4	Properties of nanoparticles: optical, magnetic, mechanical, thermal and catalytic property with examples.	2	15
6.5	Application nano materials- Nano sensors and Quantum dots(basic idea)	1	13

Text books

1. M C Day and Selbin, "Theoretical Inorganic Chemistry",
2. F A Cotton, G Wilkinson ,"Basic Inorganic Chemistry", Wiley
3. J D Lee, "Concise Inorganic Chemistry ,.ELBS
4. Puri ,Sharma and Kalia, Inorganic Chemistry, Vishal Pub.lishing House
5. T Pradeep, Nano, The Essentials, Mc Graw Hill Education

For Further Reading

1. S Glasston,"Source Book on Atomoc Energy", East West Press Pvt. Ltd, New Delhi
2. J E Huheey Inorganic Chemistry, Principles, structure and Reactivity, by
3. H S Arnicker,"Essentials Nuclear Chemistry", New Age international (P)Ltd, New Delhi
4.Manas Chanda, " Atomic Structure and Chemical bonding in Molecular Spectroscopy",Tata Mc Graw Hill

UNIVERSITY OF KRALA

Model Question Paper of B.Sc. Chemistry Programme

2020 admissions onwards

SEMESTER -III Core Course-II Course Code – CH1341 Credit-3

INORGANIC CHEMISTRY II

Time: 3 Hours **Maximum Marks: 80**

SECTION A

(Answer **all** questions. Each question carries **1** mark)

1. Calculate the bond order of O_2^+
2. C_{60} is called ------------
3. What are nano sensors?
4. Name the type of hydrogen bonding in salicylaldehyde.
5. Draw the structure of inorganic benzene.
6. Write an example for inter halogen compound.
7. Give an example for phosphorus based polymer.
8. Name a naturally occurring radioactive isotope.
9. Write an example of carboranes?
10. What is zeolite?

SECTION B

(Answer any **8** questions. Each question carries **2** Marks)

11. Compare the properties of borazole with benzene.
12. Explain one method of preparation of gold nano particles.
13. Enumerate the applications of nano particles in medicine and electronics
14. Write a note on Fajan's rule.
15. Calculate the bond order of N_2 and C_2.
16. What are the limitations of VBT?
17. Explain the 'banana bond' in diborane.
18. Define lattice energy?
19. Differentiate between Rad and Roentgen units.
20. What is the criterion of a stable nucleus?
21. Write a note pseudo halogens.
22. Give a suitable example of dipole-dipole interaction

SECTION C

(Answer any **6** questions. Each question carries **4** Marks)

23. Draw the MO diagram for NO and CO molecule
24. Give a comparative account of VB and MO theories using relevant examples.
25. What is meant by dipole moment? How is it helpful in explaining the structure of molecules?
26. Write a note on the preparation of nano particles using sol-gel method.
27. Explain the optical, magnetic properties of nanoparticles with examples.

28. Write the hybridisation and structures of Xenon fluorides.
29. Explain artificial transmutation with an example.
30. How is mass defect related to Nuclear binding energy?
31. Write a note on the manufacture of glasses.

SECTION D

(Answer any **2** questions. Each question carries **15** Marks)

32. (a) Explain VSEPR theory with example (5 marks)

(b) Write a note on

i) solvation energy and solubility of ionic solids (5 marks)

ii) secondary bond forces (5 marks)

33.(a) Explain the measurement of radio activity by

i) GM counter (5 marks)

ii) Scintillation counter (5 marks)

(b) Write a note on radio carbon dating. (5 marks)

34. (a) Write a note on disintegration series. (6 marks)

(b) Explain the structure of silicates. (5 marks)

c) Give an account of oxy acids of phosphorus (4 marks)

35. (a) Write a note on carbon nanotubes and fullerenes (6 marks)

(b) Radio active carbon in wood decay with a half life of 5770 years.

What is the rate constant (in $year^{-1}$) for the decay?

What fraction would remain after 11540 years? (4 marks)

(c) Give an account of band theory (6 marks)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	IV
Course	Core course-III
Course name	**ORGANIC CHEMISTRY – I**
Course Code	CH 1441
Credit	3
Hours	54 hours
Lecture-Tutorial-Lab	**3-0-2**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Recall the fundamentals of organic chemistry.	R	PSO1
2	Apply the electron displacement effects to compare acidity, basicity and stability of organic compounds/intermediates.	A	PSO4
3	Judge the reaction mechanism of substitution and elimination on the basis of the structure of alkyl halides.	U	PSO10
4	Summarise the chemistry of reaction intermediates.	U	PSO10
5	Discuss optical, geometrical and conformational isomerism of organic compounds.	U	PSO11
6	Use CIP rules to predict the configuration of organic compounds	A	PSO10
7	Differentiate photochemical and thermal reactions.	U	PSO11
8	Discuss theory of colour and constitution and the method of synthesis of dyes	U	PSO8
9	Explain aromaticity, orientation effect and mechanism of aromatic electrophilic substitution.	U	PSO10
10	Demonstrate the method of determination of reaction mechanism.	A	PSO10

R-Remember, U-Understand, A-Apply

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Introduction to organic chemistry**	**3**	
1.1	Uniqueness of carbon: classification of organic compounds, Functional groups (mention only), Review of basic rules of IUPAC nomenclature and IUPAC naming of organic compounds.	1	1
1.2	Types of reagents: Electrophiles and Nucleophiles. Definition of reaction mechanism. Drawing of electron movements with arrows: curved arrow notation, Half headed and double headed arrows.	2	1

	Nature of bond fissions: Homolysis and heterolysis.		
2	**Reaction mechanism I**	**9**	
2.1	Electron displacement effects: Inductive effect, electromeric effect, mesomeric effect, resonance, hyperconjugative and steric effects.	2	2
2.2	Acidity and basicity of organic compounds based on electron displacement effects: Acid characters of alcohols, phenols (phenol, o/m/p-cresols and o/m/p-nitro phenols) and carboxylic acids (aliphatic acids, mono, di, tri chloro acetic acids, Benzoic acid, o/m/p-nitro benzoic acids) and basic character of amines (aliphatic amines, aniline, N- & N,N-dimethyl aniline, o/m/p-nitro anilines ando/m/p- toluedienes)	2	2
2.3	Effects of hyperconjugative effect: stability of alkenes, alkylbenzenes, free radicals and carbocations. Dipole moment of propene and toluene.	1	2
2.4	Reaction intermediates: Carbocations, carbanions, free radicals and carbenes (definition, hybridization, structure, classification, formation, stability and important reactions), rearrangement of carbocations nitrenes(mention only).	2	2/4
2.5	Methods of determination of reaction mechanism: product analysis, intermediates, isotopic labeling (only benzyne mechanism), kinetic and stereo chemical evidences (Walden inversion).	2	10
3	**Reaction Mechanism II**	**9**	
3.1	Aliphatic nucleophilic substitutions: mechanism of SN1 and SN2 reactions, Effect of nature of substrate and solvent in substitution reactions , Stereochemistry of SN reactions ,Stereospecificity and Stereoselecticity in SN reactions , Walden Inversion. Neighbouring group participation (anchimeric assistance): Participation of lone pair of electrons in substitution reaction, mechanism of base catalysed hydrolysis of mustard gas only.	3	3
3.2	Elimination reaction: 1,1 and 1,2 eliminations, mechanisms of E1 and E2 reactions, Regioselectivity in elimination reactions (Hoffmann and Saytzeff rule and Bredt's rule). Stereo chemical pathways of elimination: Syn and Anti eliminations. Substitution vs Elimination.	3	3
3.3	Addition reactions: mechanism of addition of bromine and hydrogen halides to double bonds6y, Regioselectivity in addition reaction (Markownikoff's rule and peroxide effect). Cis-hydroxylation, Diels Alder addition, 1,2- and 1,4- additions in 1,3-butadiene.	3	3
4	**Stereochemistry I**	**6**	
4.1	Representation of organic molecules: Fischer, Flying wedge, Sawhorse and Newman projection formulae.	1	5
4.2	Conformational isomerism : conformation , Dihedral angle , Torsional strain , conformational analysis of ethane and n-butane including energy diagrams	2	5
4.3	Baeyer's strain theory , Sache-Mohr theory of strainless rings, Pitzer strain	1	5
4.4	Conformation of cyclohexane (chair, boat and skew boat	2	5

	forms),axial and equatorial bonds ,ring flipping,conformers of mono and dialkyl substituted cyclohexanes.		
5	**Stereochemistry II**	**9**	
5.1	Optical Isomerism: Chirality and elements of symmetry, DL notation, Enantiomers Optical isomerism in glyceraldehydes, lactic acid and tartaric acid Diastereoisomers, meso compounds	2	6
5.2	Cahn-Ingold-Prelog rules, R-S notations for optical isomers with one and two asymmetric carbon atoms, erythro and threo representations. Racemic mixture, resolution, methods of resolution.	2	5/6
5.3	Enantiomeric excess , Introduction to asymmetric synthesis Optical activity in compounds not containing symmetric carbon atoms: biphenyls and allenes.	2	6
5.4	Geometrical isomerism: cis-trans, syn-anti and E-Z notations , geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes , methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration and cyclisation	3	6
6	**Organic Photochemical Reactions and Dyes**	**9**	
6.1	Introduction – photochemical Vs thermal reactions. Single and Triplet states b , Allowed and forbidden transition. Photosensitization	1	7
6.2	Photochemical reactions of olefins: Photodimerisation Photochemistry of carbonyl compounds: Norrish I (Acetone), Norrish II cleavages.	2	7
6.3	Introduction to pericyclic reaction: Electrocyclic, cycloaddition and sigmatropic reactions.(Elementary idea only)	2	7
6.4	Dyes: Theory of colour and constitution , classification according to structure and method of application. Preparation and uses of 1) Azo dye - methyl orange, congored, 2) Triphenyl methane dye - malachite green, 3) Phthalein dye - phenolphthalein, 4) Xanthen dye - fluorescein, 5) Anthraquinone dye - alizarin 6) Vat dye - indigo. Optical brightners – Introduction and important characteristics.	4	8
7	**Arenes and Aromaticity**	**9**	
7.1	Heat of hydrogenation and heat of combustion of benzene, structure of benzene , Concept of aromaticity – Application of Huckel's rule to benzenoid and nonbenzenoid compounds (naphathalene, anthracene, annulenes, cyclic carbocations and anions, five membered heterocylics, azulene, fulvene)	3	9
7.2	Electrophilic substitution reactions in benzene: Mechanism of halogenation, nitration, sulphonation and Friedel Craft's alkylation and acylation, energy profile diagram.	2	9
7.3	Ring activating and deactivating groups with examples. Orientation effect in mono substituted benzene - –OH, -NH2, NO2, -CH3, -CHO, COOH and halogens.	2	9
7.4	Aromatic nucleophilic substitution – Uni and bimolecular displacement mechanism , Elimination and Addition mechanisms	1	9
7.5	Reactivity of naphthalene towards alkylation, nitration and sulphonation. Basic idea of carcinogenic polynuclear arenes.	1	9

Text books:

1. A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand & Company, New Delhi.
2. L.G.Wade Jr, Organic Chemistry, Pearson Education, New Delhi.
3. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
4. S.C.Sharma and M.K.Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi.
5. D.Nasipuri, Stereochemistry of Organic Compounds: Principles and Applications, New Age International Publizhers, New Delhi.
6. J.Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
7. I L Finar, "Organic Chemistry" Vol – 1, 5th Edition, Pearson Education, NewDelhi
8. Jagadamba Singh and Jaya Singh, Photochemistry and Pericyclic rections, New Age International, New Delhi.

For Further Reading

1. P.S.Kalsi, Organic Reactions, Stereochemistry, and Mechanism, New Age International Publishers, New Delhi
2. R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
3. P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
4. Peter Sykes, A Guide Book to Mechanism in Organic Chemistry, Pearson Education, New Delhi.
5. G.M. Louden, Organic Chemistry, Oxford University Press, New York.
6. E.L.Eliel, Stereochemistry of Carbon compounds, Tata McGraw Hill Publishing House, New Delhi.
7. J.March, Advanced Organic Chemistry, John Wiley & Sons., NY.
8. S.M.Mukerji and S.P.Singh, Reaction Mechanism in Organic Chemistry, McMillan Publishers.
9. R.O.C. Norman and J.M.Coxon, Principles of Organic Synthesis, CRC Press.

UNIVERSITY OF KERALA

Model Question Paper of BSc Chemistry Programme

2020 Admission onwards

SEMESTER IV Core Course III Course Code CH1441 Credit-3

ORGANIC CHEMISTRY I

Time:3 hours Max.Marks : 80

SECTION – A

*(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)*

1. What is the product formed when a bond undergoes homolytic fission?
2. Give one example for each (i) substitution reaction and (ii) elimination reaction.
3. Write an example for electrocyclic reaction.
4. Name two reagents used for cis-hydroxylation.
5. What are the products obtained when naphthalene undergoes sulphonation at different temperatures?
6. Identify the orienting effect of the following functional groups $–CH_3$, $-NO_2$, -CHO and –OH.
7. What are chromophores?
8. What is stereo selectivity?
9. What is geometrical isomerism?
10. What are optical brightners?

(1 X 10 =10 Marks)

SECTION - B

(*Short answer type. Answer* ***any 8*** *questions from the following.* ***Each*** *question carries* ***two*** *marks.)*

11. What are electrophiles and nucleophiles? Give examples
12. Write the structure of the following compounds (i) 3,3,4-trimethyl-4-heptene (ii) 2-ethyl-3-methyl hexanal.
13. Phenol is acidic while ethanol is not. Why?
14. Arrange the following in the decreasing order of stability. Justify your answer.
$(CH_3)_2CH^+$, CH_3^+, $(C_6H_5)_2CH^+$, $C_6H_5CH_2^+$
15. Give an example and state Hofmann rule.
16. What is Walden Inversion?
17. What is Kharasch effect? Illustrate with an example.
18. When toluene is nitrated the major products are ortho and para substituted products. Why?
19. State Huckel's rule.
20. Explain photosensitization with an example.
21. What is enantiomeric excess?
22. Explain with examples the importance of dipole moment measurements in distinguishing geometrical isomerism.

(2 X 8 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks*.)

23. What is inductive effect? How is it affect the acidity and basicity of organic acids and bases?
24. Explain the mechanism of E1 and E2 eliminations.
25. *o*-chloro toluene when treated with sodamide in liquid ammonia gives *o*-toluidine and *m*-toluidine. Explain this observation with relevant mechanism.
26. Explain Norrish I and Norrish II reactions.
27. Determine the R & S notations of the asymmetric carbon atoms in (+) tartaric and (-) tartaric acid
28. Explain the conformational analysis of *n*-butane.
29. Give a brief account on optical activity due to restricted rotation.
30. Explain any two methods of determination of reaction mechanism.

31. What are non-benzenoid aromatics compounds? Explain their aromaticity with examples

(4 X 6 =24marks)

SECTION – D

(*Answer **any2** question. Each question carries 15 marks*)

32. (a) Explain S_N1 and S_N2 mechanisms.
(b)Write the influence of structure of the substrate and polarity of the solvent on nucleophilic substitution reactions.
(c) Explain Baeyer's strain theory. (5+5+5)

33. (a) Explain the mechanism of (i) nitration (ii) halogenation of benzene.
(b) Discuss the orientation of influence of $–NO_2$ and –OH group in aromatic electrophilic substitution.
(c) Discuss the classification of dyes on the basis of structure.
(5+5+5)

34. (a) What is resolution? Explain any two methods of resolution.
(b) What are carbenes? How are they generated? Comment on the structure of carbene.
(c) Draw conformers of dimethyl cyclohexane and discuss their comparative stability.
(5+6+4)

35. (a) Write the synthesis and uses of the following dyes (i) Malachite green (ii) Methyl Orange.
(b) Explain the geometrical isomerism of maleic and fumaric acid.
(c) What is hyperconjugative effect? How is it useful to explain the stability of carbonium ions?

(6+4+5)

(15 X 2 = 30marks)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	V
Course	Core Course V
Course name	**PHYSICAL CHEMISTRY I**
Course Code	CH 1541
Credit	4
Hours	54 hours
Lecture	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive level	PSO
1	Identify, compare and explain the properties and behaviourof ideal and real gases, knowing kinetic theory of gases and different types of molecular velocities and collision properties.	U	PSO11
2	Perform numerical problems of gases under a set of conditions	A	PSO2
3	Differentiate between amorphous and crystalline solids, Understandanisotropy, symmetry and types of crystals, X-ray diffraction methods of study of crystal structure, identify the imperfections in crystals understand the physical aspects of surface tension and viscosity of liquids and the basics of liquid crystals and their applications	U	PSO11
4	representation of lattice planes and calculation of interplanar spacing, draw the crystal structures of NaCl and CsCl	A	PSO9
5	Recalling the basic concepts of solutions, concentration terms, Raoult's law and colligative properties	U	PSO9
6	Determination of colligative properties and molecular mass of solute	E	PSO9
7	Understand the working principle Electro-Chemical cells	U	PSO9
8	Design and Determine the potentials ofelectrochemical systems	E	PSO2
9	Assess the nature of electrolytes in terms of dissociation and ionic conductance of electrolytes in terms of mobility of ions	E	PSO2
10	Integrate the theory into practical applications of conductometric titrations	A	PSO3

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Gaseous state**	**9**	
1.1	Ideal gas, Ideal gas equation, gas constant: values in different units ($JK^{-1}mol^{-1}$, L atm $K^{-1}mol^{-1}$, cal $K^{-1}mol^{-1}$.), Dalton' Law of Partial pressure- Definition and mathematical expression.	1	1
1.2	Kinetic Theory of gases: postulates,Types of molecular velocities (average, most probable and RMS), formulas and their inter relations. Maxwell Boltzmann distribution of molecular velocities (with plots), Effect of temperature on distribution of molecular velocities	2	1/ 2
1.3	Collision properties. Collision diameter, Collision number, Collision frequency and mean free path. Relation between collision parameters and viscosity and thermal conductivity of gases (no derivation).	1	1/ 2

1.4	Behaviour of real gases, Deviation from ideal behaviour, Explanation for deviation, Compressibility factor, Z-P plots of ideal gas and the real gases H_2, He, NH_3, CO and methane at 0°C, Z-P plots of N_2 at several temperatures. van der Waal's equation of state – Correction factors. van der Waal's equation at low and high pressures and at high temperature.	2	1/ 2
1.5	Boyle temperature, Boyle temperature in terms of van der waal's constant. Virial equation of state and virial coefficients. (no derivations)	1	2
1.6	Critical phenomena: PV-Isotherms of CO_2, continuity of states, critical point, Critical constants, relation between critical constants and van der Waals constants, Experimental determination critical constants.	2	2
2	**Solids, Liquids and Liquid Crystals**	**12**	
2.1	Amorphous and Crystalline solids. Isotropy and anisotropy, size and shape of crystal, Interfacial angle, types of crystals: molecular crystals, ionic crystals, covalent crystals and metallic crystals- examples and properties.	1	3
2.2	Symmetry of crystals- plane of symmetry, axis of symmetry, centre of symmetry (definitions and basic idea only), Seven basic crystal systems, Space lattice and unit cell, Bravais lattices, (unit cell parameters and examples of 14 Bravis lattices), close packing structures of cubic and orthorhombic space lattices.	2	3
2.3	Laws of rational indices, Miller indices, Representation of lattice planes of cubic crystals, interplanar spacing in crystals Determination of Avogadro number from crystallographic data	2	4
2.4	X-ray diffraction studies of crystals, Bragg's equation – derivation and applications, Rotating crystal and powder method. Structure of NaCl and CsCl	2	4
2.5	Imperfections in crystals. Stoichiometric and Non-stoichiometric defects, point defects – Schottky and Frenkel defects, F-centre	1	3
2.6	**liquid state** : Properties of liquids: Vapour pressure-definition and concept, Surface tension-factors affecting Surface tension and measurement by capillary rise and stalagmometer method	1	3/ 4
2.7	Viscosity- Poisuelle's equation, Determination of viscosity by Ostwald's viscometer, Refractive index-determination by Abbe refractometer	1	4
2.8	**Liquid Crystals :** Liquid crystals- introduction, characterization of liquid crystals, Types –smectic, nematic and cholesteric liquid crystals,- examples; Disc shaped liquid crystals, Polymer	2	3

	liquid crystals. uses of liquid crystals		
3	**Dilute solutions and colligative properties**	**9**	
3.1	Dilute solutions: Binary solutions, Concentration-Molarity, Molality, Normality and Mole fraction. (numerical problems)	2	5
3.2	Raoult's Law for solutions of non-volatile solutes, vapour pressure of ideal solutions and relative lowering of vapour pressure.	1	5
3.3	Colligative properties- lowering of vapour pressure; elevation of boiling point and depression in freezing point; molal elevation constant, molal depression constant, Thermodynamic derivation of ΔT; Osmosis and Osmotic pressure, van't Hoff equation; Isotonic, hypertonic and hypotonic solutions, Abnormal molecular mass and van't Hoff factor, Determination of degree of dissociation and association, Reverse osmosis (numerical problems).	4	5/ 6
3.4	Experimental determination of molecular mass of solutes by cooling curve method,Rast's and Beckmann methods	2	6
4	**Electrolytic conductance**	**12**	
4.1	Electrolytic conductance, specific and equivalent conductance and the relation between them. Molar conductance and its variation with dilution, Kohlraush's law and its applications , cell constant	2	7
4.2	Ionic mobility, transport number- determination by Hittorf's and moving boundary method	2	7
4.3	Applications of conductivity measurements:- Determination of degree of dissociation of weak electrolytes, degree of hydrolysis, solubility of sparingly soluble salts, conductometric titrations involving strong acid strong base, strong acid-weak base, weak acid- strong base, weak acid-weak base and precipitation.	2	7, 10
4.4	Debye-Huckel theory of strong electrolytes, Debye-Huckel-Onsager equation, Debye-Falkenhagen effect, Wien effect	2	7
4.5	Activity and activity coefficient of electrolytes, Ionic strength	2	7
5	**Electromotive force**	2	8
5.1	Electrochemical cells- definition, types- electrolytic and galvanic with examples (Daniel cell and electrolysis of Cu), Origin of electrode potential, half cell reaction and	**12**	9

	cell reactions.		
5.2	Types of electrodes-Metallic electrodes, anion reversible electrodes and redox electrodes, Reference electrodes-standard hydrogen electrode, calomel electrode and	2	9
5.3	Effect of concentration of electrolytes on electrode potential: Nernst equation for electrode and cell (Derivation), Numerical problems	2	10
5.4	Relation between electrical energy, free energy, enthalpy and entropy- Gibb's Helmholtz equation and EMF of a cell -calculation of ΔG, ΔH and ΔS from EMF data.	3	9
5.5	Concentration cells - electrode and electrolyte concentration cells,examples, with and without transference (no derivation),fuel cells –H2-O2 and hydrocarbon-O2	3	9
5.6	Applications of EMF measurements- Determination of pH using hydrogen electrode and potentiometric titrations of redox systems with Fe/Cr system	2	8,10

(At least 100 problems are to be worked out from all units together. 30% of the questions for Examination shall contain problems.)

Textbooks

1. Gurdeep Raj, "Advanced Physical Chemistry", Goel Publishing House

2.P W Atkins, "Physical Chemistry", Oxford University Press

3. Anthony R West, " Solid State Chemistry and its Applications", Wiley Eastern

4. V Ramakrishnan and M S Gopinathan, "Group Theory in Chemistry",Vishal Publishing Co.

5.Puri, Sharma and Pathania, "Principles of Physical Chemistry", Millennium Edition, Vishal Publishing Co

For Further Reading

1 A. Salahuddin Kunju and G. Krishnan "Group Theory and its Applications in Chemistry

2. R J Silby and R A Alberty, "Physical Chemistry", John Wiley & Sons

3. G W Castellan, "Physical Chemistry", Narosa Publishing House

4. F Daniels and R A Alberty, "Physical Chemistry", Wiley Eastern

5. E A Moelwyn Hughes, " Physical Chemistry", Pergamon Press

6.R.Stephen Berry,Stuart A.Rice,John Ross,"Physical Chemistry,2nd edition,Oxford".

7. S Glasstone, "Thermodynamics for Chemists", Affiliated East West Publishers

8.L V Azaroff, " Introduction to Solids", McGraw Hill

9. N B Hannay, " Solid State Chemistry", Prentice Hall

10. A.S.Negi and S.C.Anand, A text book of Physical Chemistry, New Age International publishers.

UNIVERSITY OF KERALA

Model Question Paper of B.Sc. Chemistry Programme 2020 Admissions onwards

SEMESTER- V Core Course- V Course Code 1541 Credit-4

PHYSICAL CHEMISTRY –I

Time: 3 Hrs Total marks: 80

SECTION A

Answer all the questions. Each question carries 1 mark

1. Write down the van der Waal's equation for n moles of a gas.
2. Write down the conditions at which real gases tend to approach ideal behaviour
3. Explain the Braggs equation
4. Depict the structure of CsCl.
5. Identify the use of Stalagmomter.
6 Represent the cell diagram of Daniel cell
7. Name a primary reference electrode.
8. In which type of liquid crystals, the colour of the material is sensitive to temperature changes
9. How will you express the degree of dissociation in a weak electrolyte?
10. Explain the Gibb's Helmholtz equation for the emf of a cell.

(1 x 10 = 10 marks)

SECTION B

Each question carries 2 marks (Short answer). Answer any **8** questions

11. Distinguish between RMS and most probable velocity.
12. Distinguish between isotropy and anisotropy.
13. Calculate the Miller index of of a plane with x=1,y=1/2 and z=1.
14. Explain elements of symmetry of crystals
15. Comment on the statement that Depression in freezing point is a colligative property.
16. Calculate the normality of a solution containing 10 gram NaOH in 250 mL of NaOH solution.
17. How is the EMF generated in a concentration cell? Explain..
18. How will you carry out potentiometric titration of HCl and NaOH?
19. Derive the Nernst equation for the reduction of Cu^{2+} to Cu.
20. Define Kohlraush's law
21. Name a common anion reversible electrode and give its reduction half cell representation
22. Define transport number. Suggest one method for its determination.

($2\times8 = 16$)

SECTION C

Each question carry 4 marks (Short essay) **Answer any 6 questions**

23.What is the law of corresponding states? How is it derived from van der Waals equation

24. Derive the Bragg equation. What is its application?

25.The average speed of a certain gas at 27^{o}C is 400ms^{-1}. Calculate the temperature at which the speed will be 800ms^{-1}.

26. How will you determine Avogadro number from crystallographic data?.

27. Write a note on the different types of Liquid crystals

28. Discuss on cubic and hexagonal close packing in crystals. Give example for each.

29. Differentiate between molecular and covalent crystals.

30. Calculate the wave length of X rays used for a first order reflection in NaCl crystal. The inter planar spacing is 0.281nm for this reflection.

31. Derive an expression for pH measurement using Hydrogen electrode.

(4 x 6 = 24 marks)

SECTION D

Answer any two questions. Each question carries 15 marks

32. a)Do all gases obey gas laws? Discuss some experimental results to explain deviation and point out the causes which accounts for this behaviour (5 marks)

b) Explain with diagrams the influence of temperature on molecular velocities in gases. (5marks)

c) Write a note on continuity of states and critical points. (5marks)

33. a) Derive Bragg's equation. (5 marks)

b) The edge length of the unit cell of NaCl crystal lattice is 564 pm by X-ray diffraction. Compute the interionic distance between sodium and chloride ions. (5 marks)

c) Give an account of point defects in a crystal. (5 marks)

34. a) An aqueous solution containing 0.50 g of a solute, dissolved in20 g of water froze at 272.58K. Calculate the molar mass of the solute. Enthalpy of fusion of ice, at 273K is 6024.6 J/mol. (5 marks)

b) b)Briefly discuss on the determination of viscosity of liquids. (5 marks)

c) (Explain with necessary diagrams the conductometric titrations of acids and bases. (5 marks)

35. a). Calculate the following

i) the free energy change for the cell , $Zn/Zn^{2+}// Cu^{2+}/Cu$ with an EMF of 1.1 volt at 25^0C.

ii) the electrode potential of Cu^{2+}/Cu in the above cell if the electrode potential of Zn/Zn^{2+} is 0.76 volt.

(5marks)

b) How will you construct a concentration cell using Zn metal electrode and zinc sulphate solution? (5 marks)

c) Give an account of Standard hydrogen electrode and Calomel electrode. (5 marks)

(15x2=30)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	V
Course	Core course-VI
Course name	**INORGANIC CHEMISTRY III**
Course Code	CH 1542
Credit	4
Hours	72 hours
Lecture-Tutorial-Lab	4-0-3

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the electronic configuration and related properties of transition elements and inner transition elements	U	PSO11
2	Understand preparation of selected transition metal compounds,lanthanides and actinides	U,A	PSO11

3	Compare lanthanide and actinide contraction and their consequences.	U	PSO11
4.	Name coordination complexes,organometallics, discuss their properties and bonding	U	PSO11
5	Understand stability of complexes and factors affecting stability	U	PSO3
6	Discribe isomerism in coordination compounds	U, A	PSO3
7	Discuss spectrochemical series, CFSE and their consequences	U	PSO3
8	Correlate geometry , stability and Jahn Teller effect and its causes	A	PSO11
9	Discuss reaction mechanisms and applications of coordination compounds	U	PSO11
10	Name and Classify organometallic compounds	U	PSO3
11	Discuss preparation and properties and bonding of carbonyls	U	PSO3
12	Identify the role of organometallic compounds in organic synthesis	U	PSO10
13	Discuss the role of inorganic ions in biological systems and biochemistry of haemoglobin, myoglobin, cytochromes, iron sulphur proteins	U	PSO10
14	Discuss various bioinorganic processes like photosynthesis, working of sodium potassium pump, etc	U	PSO17
15	Discribe various aspects of metallurgy,and instrumental methods of analyses viz., spectrophotometric methods, thermal methods and tools available to measure nanomaterials	U	PSO6

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Transition elements and Inner transition elements-I**	**9**	
1.1	Electronic configuration and general characterisitics- Oxidation state, Ionization enthalpy (variation of I,II and III ionization enthalpy across 3d series) and Enthalpy of atomisation	2	1
1.2	Melting and boiling point, density and Variation of std. electrode potentials (E^o M^{2+}/M & E^o M^{3+}/M^{2+})	2	2
1.3	Stability of higher oxidation states and formation of complexes	1	2
1.4	Colour, magnetic property and catalytic property	1	2
1.5	Comparison of 3d, 4d and 5d transition series	1	3
1.6	Preparation, properties and uses of $K_2Cr_2O_7$, $KMnO_4$ and $TiCl_4$. Important application of transition metals	2	4,5

2	**Transition elements and Inner transition elements-II**	**9**	
2.1	Electronic configuration, general properties (including oxidation state, I.E., melting and boiling points, density, ionic radii, colour, etc) and reactions of Lanthanides and actinides	3	6
2.2	Occurrence and isolation of lanthanides from monazite(Special reference to mineral sands of Kerala)	2	7
2.3	Lanthanide contraction, actinide contraction and their consequences	2	8
2.4	Magnetic properties and complexation behaviour of lanthanides and actinides (with comparison)	2	8
3	**Coordination chemistry-I**	**9**	
3.1	Ligands and their classifications and nomenclature of complexes (latest version)	2	9
3.2	EAN rule – Chelates – Stability of complexes and Factors affecting stability of complexes	1	10
3.3	Isomerism – Structural and stereoisomerism – Geometrical and optical isomerism	2	11
3.4	Bonding in complexes – V.B. Theory, CFT applied to Octahedral, Tetradral and square pyramidal complexes. factors affecting crystal field	4	12
4	**Coordination chemistry –II**	**9**	
4.1	Spectrochemical series – CFSE, Magnetic properties and colour of metal complexes .	3	13
4.2	Effects of crystal field splitting –Jahn -Teller effect- Tetragonal distortion of an octahedral complex	3	14
4.3	Application of coordination compounds in metallurgy, volumetric - quantitative and qualitative analysis. EDTA as a titrant.	2	15
4.4	Reactions of metal complexes-labile &inert complexes, ligand substitution reactions- SN1 & SN2 reactions	1	16
5	**Organometallic and Bioinorganic chemistry-I**	**9**	
5.1	Definition and nomenclature of organometallic compounds.	1	17
5.2	Classification as Sigma, Pi and mixed (containing both Sigma and pi) complexes, 18 electron rule	2	18
5.3	Metal carbonyls- mononuclear and polynuclear (give examples with Fe, Co and Ni)	2	19
5.4	Preparation and properties of carbonyls (Fe, Ni, Mn, Cr), Vibrational frequency of CO bond in metal carbonyls.	2	19

5.5	Bonding in organometallic compounds like ferrocene, dibenzene chromium, Ziese's salt (without MOT) and dinitrogen complexes.	2	20
6	**Organometallic and Bioinorganic chemistry-II**	**9**	
6.1	Application of organometallic compounds	2	21
6.2	Bioinorganic chemistry- Role of metal ions in biological systems- Biochemistry of iron-haemoglobin and myoglobin (elementary idea of the structure and mechanism of their actions)	3	22, 23
6.3	Electron transport proteins: Cytochromes, Iron-Sulphur proteins- storage and transport of iron.	2	23
6.4	Photosynthesis, Sodium -Potassium pump, Biochemistry of magnesium and calcium (brief study only)	2	24
7	**General Principles of Isolation of elements**	**9**	
7.1	Methods of concentration of an ore- Gravity separation, Froth floatation, Magnetic separation, Leaching, electrostatic separation, automated ore sorting and dewatering.	2	25
7.2	Preliminary processes- calcination and roasting.	1	25
7.3	Methods of extracting metal from concentrated ore- Electrometallurgy- Metallurgy of Aluminium, Sodium- Pyrometallugy-	2	25
7.4	Metallurgy of iron and zinc	1	25
7.5	Aluminothermy, auto-reduction and hydrometallurgy- metallurgy of silver and gold	1	25
7.6	Purification of crude metal- Distillation, Liquation, Zone refining, Electro refining , Chromatographic techniques and Vapour phase refining (Mond's process and Van Arkel process)	2	25
8	**Instrumental methods of Analysis**	**9**	
8.1	Spectrophotometry- Laws of spectrophotometry- Beer Lambert's Law	1	26
8.2	Applications of spectrophotometry- colorimetry, atomic absorption spectroscopy and flame emission spectroscopy.	3	26
8.3	Thermal methods- introductory aspects of TG, DTA and DSC- Instrumentation and applications.	2	27
8.4	Tools for measuring nanostructures: XRD, AFM, STM, SEM and TEM	3	28

Text Books

1. B.R.Puri, L.R,.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers
New Delhi,2010
2. S.Prakash,G.D.Tuli, S.K Basu, R.D.Madan,Advanced Inorganic Chemistry, Vol. 1.,S Chand
3. R. Gopalan, V. Ramalingam, Concise coordination chemistry, 1st Edn., Vikas Publishing house
4. J.E.Huheey,E.A.Keiter, R.L.Keiter, O.K.Medhi. Inorganic Chemistry, 4th Edn. Pearson, 2006
5. D.A.Skoog, F.James Holler. S.R. Crouch. Principles of Instrumental analysis, 6th Edn., Cengage Learning, Noida,2004.

For Further Reading

1. D.A.Skoog, F.James Holler, T.A.Nieman. Principles of Instrumental analysis, 6th Edn., Cengage Learning, India Ltd.
2. A.Cottrel, An Introduction to Metallurgy, 2nd Edn. University Press, 1990.
3. D.C.Harris, Qualitatve Chemical Analysis,5th Edn., W.H. freeman & Co. New York.
4. F.A.Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley, India(P)Ltd

UNIVERSITY OF KERALA

Model Question Paper of B.Sc. Chemistry Programme

2020 admissions onwards

SEMESTER- V Core Course- VI Course Code CH1542 Credit-4

INORGANIC CHEMISTRY III

Time: 3 Hours **Maximum Marks : 80**

SECTION A

Answer all questions, each question carries 1 mark (answer in a word\sentence)

1. Give the general outer electronic configuration of a transition element
2. Which is more basic; $La(OH)_3$ or $Lu(OH)_3$?
3. Which is the catalyst used in the oxidation of SO_2 to SO_3 in contact process?
4. Give an example for a mono nuclear and a binuclear carbonyl.
5. What is the coordination number of Ag in [Ag(CN)2] ?
6. Give the IUPAC name of Na3[Co(CO3)3]
7. What is the unit of magnetic moment?
8. Give the example for a tridentate ligand.
9. Write the structure of ferrocene.
10. Give the formula of a metal carbonyl which does not obey 18-electron rule. (1 x 10 = 10)

SECTION B

Answer any 8 questions, each question carries 2 marks (short

answer questions)

11.Explain zone refining.
12.Name the metal ion, other than magnesium, involved in photosynthesis.
13. Explain the stability of EDTA metal complexes.
14. How is the ore galena purified?
15. What is the oxidation number of P in H_3PO_4?
16. Give the importance of a cytochromes.
17. Transition metals are less reactive than the alkali and alkaline earth metals - Justify.
18. Which is more stable: Cu^{2+} or Cu^{+}in aqueous solution. ? Substantiate your answer.
19. Which has got greater tendency to form complexes; lanthanides or actinides ? Give reasons.
20. Write the difference between calcinations and roasting
21. What is an ambidentate ligand ? Give example.
22. Explain geometrical isomerism in metal complexes with suitable example (**2x8=16)**.

SECTION C

Answer any 6 questions, each question carries 4 marks **(short essay type)**

23.What is Ziese's salt ? Give its structure.
24. State and explain 18-electron rule with examples .
25. How haemoglobin differ from myoglobin.
26. Write notes on AAS and Flame Emission Spectroscopy.
27. Purification of crude metals by Monds proess and van Arkel processes
28. How does TGA differ from DTA?
29. What is lanthanide contraction ? Explain its consequences .
30. What are the factors that affect stability of metal complexes ?
31. Give an account of the applications of coordination compounds in quantitative and qualitative analysis.

SECTION D

(Answer any 2 questions, Each question carries 15 marks)

32.a) Describe the ion exchange method for the separation of lanthanides from monazite. (5 marks)

b) Describe the splitting of d-orbitals in tetrahedral and octahedral fields according to crystal field theory (5 marks)

c) Comment on the magnetic properties of lanthanides (5 marks)

33.a)Give an account of Electrometallurgy and pyrometallurgy (5 marks)

b.Discuss the nature of bonding in metal carbonyls. (5marks)

c) Narrate the use of EDTA as a titrant . (5 marks)

34.a).How silicones are prepared ? Discuss their structure and uses.

b).Give an account of sodium-potassium pump in biological systems.

c)Explain the principle of zone refining with an example.

35.a)Comment on the importance of mineral sands of Kerala ?

(5marks)

b) Explain the principle and working of AFM.

(5marks)

c)Explain the crystal field splitting in octahedral field.

(5marks)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	V
Course	Core course-VII
Course name	**ORGANIC CHEMISTRY II**
Course Code	CH 1543
Credit	4
Hours	72 hours
Lecture-Tutorial-Lab	4-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Describe the preparation of hydroxy, carbonyl & amino compounds, carboxylic acids and organo Mg, Li & Zn compounds.	R	PSO10
2	Distinguish primary, secondary & tertiary alocohols and amines.	U	PSO10

3	Write reaction steps in ascending & descending of alcohol and aliphatic acid series, interconversion of aldose and ketose, chain lengthening and shortening of aldoses.	U	PSO11
4.	Explain the structure of glucose, fructose, sucrose, starch and cellulose.	U	PSO11
5	Predict the outcome and mechanism of simple organic reactions, using a basic understanding of the reactivity of functional groups	A	PSO10
6	Illustrate the use of organic reagents in synthesis.	**A**	PSO3 PSO10
7	Discuss fundamental principles of supramolecular and green chemistry	U	PSO13

R-Remember, U-Understand, A-Apply

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Alcohols, Phenols and Ethers**	**12**	
1.1	Alcohols: Preparation- From alkenes (hydration. Hydroboration-oxidation, oxy-mercuration demercuaration) and carbonyl compounds (reduction and with Grignard reagent)	2	1
1.2	Chemical properties: Reactions involving cleavage of O-H bonds (acidity and esterification), oxidation (with PCC, Collins reagent, Jones reagent and $K_2Cr_2O_7$) and catalytic dehydrogenation	2	5
1.3	Distinction between primary, secondary and tertiary alcohols – Ascent and descent in alcohol series. Biofuel – ethanol and biodiesel.	1	2
1.4	Dihydric alcohols: Oxidative cleavage – Lead tetra acetate, periodic acid – Pinacol-pinacolone rearrangement.	1	5
1.5	Phenols: Preparation from halobenzens, cumene and sulphonic acid. Chemical properties: – Bromination, nitration, sulphonation.	2	1/5
1.6	Reimer-Tiemann reaction (mechanism expected), Kolbe reaction, Liebermann's nitroso reaction and Lederer-Mannasse reaction. Distinction between alcohols and phenols.	2	5
1.7	Ethers: Preparation by Williamson's synthesis. Reactions of ethers: Cleavage by HI and Claisen rearrangement (Mechanism expected) – Ziesel's method of estimation of methoxy group. Crown ethers: Nomenclature and importance of crown ethers.	2	5
2	**Aldehydes and Ketones**	**12**	
2.1	Preparation: Oxidation of primary and secondary alcohols using PCC, reduction of esters using DIBAL-H, Rosenmund	2	1

	reduction, Gattermann-Koch formylation and Friedel-Craft's acylation.		
2.2	Chemical properties: Nucleophilic addition (HCN, NaHSO3, RMgX and ROH)	1	5
2.3	Addition-elimination reaction (with ammonia and ammonia derivatives). Addition reactions of unsaturated carbonyl compounds: Michael addition.	1	5
2.4	Reduction using Metal hydrides (mechanism expected), MPV reduction, Clemmenson and Wolff-Kishner reduction.	2	5
2.5	Oxidation: with KMnO4, Tollen's reagent, Fehling solution, Br2 water, Oppenaur oxidation, Baeyer-Villiger oxidation.	2	5
2.6	Acidity of α-hydrogen: Aldol, Claisen-Schmidt, Benzoin, Perkin and Knovenagel condensations (all mechanisms expected).	2	5
2.7	Haloform reaction – Iodoform test – Cannizaro reaction (mechanism expected) and Beckmann rearrangement (mechanism expected)	2	5
3	**Carboxylic acids, Sulphonic acid and their Derivatives**	**9**	
3.1	Preparation: Hydrolysis of nitrile, carboxylation of Grignard reagent and oxidation of alkyl benzenes.	1	1
3.2	Chemical properties: HVZ reaction, Decarboxylation – Kolbe electrolysis (Mechanism expected), Curtis reaction. Ascent and descent series in aliphatic carboxylic acids	2	3,5
3.3	Preparation, properties and uses of anthranilic acid, cinnamic acid, citric acid, lactic acid, oxalic acid, adipic acid and phthalic acid.	3	1
3.4	Formation of acid derivatives – acid chlorides, amides, acid anhydrides and esters – comparison of reactivity of acid derivatives. Preparation of coumarin – Fries rearrangement (Mechanism expected)	3	5
3.5	Preparation and reactions of benzene sulphonic acid, toluene sulphonic acid and benzene sulphonyl chloride – Importance of tosyl group – synthesis and application of saccharin.	3	1,5
4	**Organic Nitrogen Compounds**	**12**	
4.1	Nitrocompounds: Nitro-acitautomerism, Nef's reaction. Reduction of nitrobenzene in various media. Preparation of nitro toluenes, nitro compounds as explosives.	3	5
4.2	Amines: Classification – Preparation: From alkyl halides, nitro compounds, nitriles, isonitriles and amides – Hoffmann's bromamide reaction, Schmidt reaction, Gabriel phthalimide synthesis.	2	1
4.3	Chemical properties: Carbyl amine reaction, conversion of amines to alkene (Hoffmann elimination with mechanism), acylation, reaction with nitrous acid and Mannich reaction.	2	5
4.4	Electrophilic substitution reactions of aniline: halogenation, sulphonation and nitration by amino protection (acetylation). Benzidine rearrangement (mechanism expected).	2	5
4.5	Separation of mixture of amines – methods to distinguish	1	2,5

	primary, secondary and tertiary amines. Distinction between aliphatic and aromatic amines.		
4.6	Preparation and synthetic applications of diazonium chloride and diazomethane.	2	5
5	**Carbohydrates**	**9**	
5.1	Classification and nomenclature of monosaccharides, configuration of monosaccharides.	1	
5.2	Reactions of glucose and fructose – Determination of openchain structure of D-glucose and D-fructose.	3	4,5
5.2	Anomers and mutarotation in glucose (mechanism expected) - cyclic structure – pyranose and furanose forms – Haworth projection formula – chair conformations.	2	4
5.3	Epimers and epimerization – Interconversion of aldoses and ketoses – chain lengthening and shortening of aldoses.	1	3
5.4	Disaccharides – reactions and structure of sucrose (structural elucidation not required) Polysaccharides – Structure of starch and cellulose (structural elucidation not required) – Industrial applications of cellulose.	2	4
6	**Organometallics, Active methylene compounds and Reagents in Organic synthesis**	**9**	
6.1	Organomagnesium compounds: Grignard reagent: Preparation – Reaction with compounds containing acidic hydrogen, carbonyl compounds, cyanides and CO2.	2	1,6
6.2	Organo lithium compounds: Preparation – Reaction with compounds containing acidic hydrogen, alkyl halides, carbonyl compounds, cyanides and CO2.	1	1,6
6.3	Organo zinc compounds: Preparation of dialkyl zinc – Reaction with active hydrogen compounds, acid halides and alkyl halides, Reformatsky reaction (mechanism expected) Li dialkylcuprates – Preparation and reaction with aliphatic/aromatic/vinyl halides.	2	1,6
6.4	Active methylene compounds – examples. Preparation of ethyl acetoacetate by Claisen condensation (mechanism expected), tautomerism, Synthetic applications of acetoacetic ester.	2	1,6
6.5	Reagents in organic synthesis: Study of the following reagents with respect to functional group transformations – 1. LiAlH4 – reduction of =CO, -COOR and –CONH2. 2. NaBH4 and Diborane – reduction of =CO 3. SeO2 - hydroxylation of allylic and benzylic positions, oxidation of CH2 alpha to =CO to =CO 4. NBS : Allylic and benzylic bromination.	2	6
7	**Introducing supramolecular and green chemistry**	**6**	
7.1	Supramolecular chemistry: Introduction – molecular recognition – host-guest interactions – types of non-covalent interactions.	2	7

7.2	Green Chemistry: Introduction – atom economy – principles of greenchemistry.	2	7
7.3	Newer methods of synthesis : Ultrasound, microwaves and phase transfer catalysis.	2	7

Text books

1. A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand& Company, New Delhi.
2. L.G.Wade Jr, Organic Chemistry, Pearson Education, New Delhi.
3. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
4. S.C.Sharma and M.K.Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi.
5. I L Finar, "Organic Chemistry" Vol – 1, 5th Edition, Pearson Education, New Delhi.
6. J. Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
7. Helena Dodzuik, Introduction to supramolecular chemistry, Springer.
8. V.K.Ahluwalia, Green Chemistry, Enviornmentally Benign reaction, Ane Book.

For further reading:

1. L.M. Lehn, Supramolecular Chemistry, VCH.
2. M.M.Sreevastava and Rashmi Sanghi, Green Chemistry for environment, Narosa Publishing House.
3. R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
4. P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
5. G.M. Louden, Organic Chemistry, Oxford University Press, New York.
6. V.K.Ahluwaliya, Organic Reaction Mechanisms, Narosa Publishing House, New Delhi.

UNIVERSITY OF KERALA
Model Question Paper of BSc Chemistry Programme
2020 Admission onwards
SEMESTER- V Core Course VII Course Code CH1543 Credit 4
ORGANIC CHEMISTRY II

Time:3 hours **Max.Marks : 80**

SECTION – A

*(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)*

1. What is Williamson's synthesis?
2. Which reagent is used for the oxidative cleavage of 1,2-diols?
3. Give a test to distinguish aliphatic aldehydes from aromatic aldehydes.
4. What is atom economy?
5. What is HVZ reaction?
6. What happens when aniline is treated benzoyl chloride in alkaline medium?
7. Draw the structure of D-Arabinose and D-Ribose?
8. What are epimers?
9. What is Frankland reagent?
10. Name a nitro compound used as explosive.

(10 X 1 =10 Marks)

SECTION - B

(*Short answer type. Answer **any 8** questions from the following. **Each** question carries **two** marks.)*

11. What is Mannich reaction?
12. How can you convert isopropanol to *tert*-butyl alcohol?
13. How can you distinguish 2-pentanone from 3-pentanone?
14. What is MPV reduction?
15. How coumarin is prepared?
16. How will you convert acetic acid to propionic acid?
17. Explain Nef's reaction.
18. Write the mechanism of Benzidine rearrangement.
19. Explain inversion of cane sugar.
20. Write any two industrial applications of cellulose.
21. What is NBS? What is its use?
22. What is DIBAL? What is its use?

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer **any 6** questions from the following. **Each** question carries **four** marks.)*

23. Explain Zeisel's method of estimating methoxy group?
24. How can you distinguish primary, secondary and tertiary alcohol?
25. Write the importance of $LiAlH_4$ and $NaBH_4$ in carbonyl chemistry.
26. Comment on Clemmensen and Wolff-Kishner reduction.
27. How cinnamic acid is prepared? Explain its important properties.
28. Discuss Hoffmann elimination?
29. Explain microwave synthesis with examples.
30. Discuss the mechanism of Reformatsky reaction.
31. What is mutarotation? Explain its mechanism.

6 X 4 = 24marks)

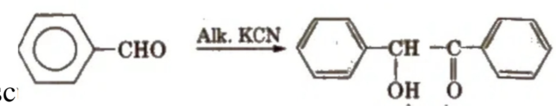
SECTION – D

(*Answer* ***any 2*** *questions. Each question carries 15marks*)

32. (a) Write the mechanism of the following reactions:

$$2CH_3-CHO \xrightarrow[\Delta]{\text{Dil. NaOH}} CH_3-CH=CHCHO$$

a. (a)



(b) Disc action and (ii) Claisen Condensation.

(c) Comment on the following (i) Biodiesel and (ii) Crown ethers.
(5+5+5)

33. (a) Explain the synthesis and applications of saccharin.

(b) How diazonium chloride is prepared? How is it useful to synthesis the following compounds: phenol, iodobenzene, azocompounds,

(c) How can you effect the following conversions (i) aniline to para-bromo aniline(ii) benzamide to aniline.
(5+5+5)

34.(a) Discuss the cyclic structure of glucose
(
(b) (i) Why glucose and fructose form same osazone?

(ii) How fructose reacts with the following reagents?

(1) Na/Hg and H_2O (2) CH_3OH and dry HCl (3) Fehling's solution.

(c) Discuss the application of the following reagents in organic synthesis (i) SeO2 (ii) Lithium alkyl cuprate.

(5+5+5)

35. (a) How primary, secondary and tertiary amines are separated?

(b) Discuss the preparation and important reactions of benzene sulphonic acid.

(c) Discuss the different types of non covalent interactions in molecules. (5+5+5)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	VI
Course	Core course-X
Course name	**PHYSICAL CHEMISTRY II**
Course Code	CH 1641
Credit	4
Hours	72 hours
Lecture-Tutorial-Lab	4-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive level**	**PSO**
1	Understand basic concepts of thermodynamics , spectroscopy and group theory	U	PSO11
2	Apply laws of thermodynamics in physical and chemical processes and real system	A	PSO1
3	Classify processes, properties and systems on a thermodynamic basis		PSO3
4	Discuss the second law of thermodynamics and Assess thermodynamic applications using second law of thermodynamics.	E, A	PSO3
5	Discuss basic concepts of statistical thermodynamics	U	PSO11

6	Solve numerical problems based on thermodynamics and thermochemistry		PSO2
7	Understand the basics of spectroscopic techniques- Rotational, Vibrational and Raman Spectroscopy	U	PSO2
8	Compare NMR and ESR spectroscopy and their applications	U	PSO3
9	Evaluate physical and chemical quantities using non-spectroscopic techniques.	U, E	PSO4
10	Identify the elements of symmetry and Determine the point groups of simple molecules	E	PSO11
11	Differentiate diamagnetism and paramagnetism, measurement of magnetic susceptibility	U	PSO11
12	Correlate dipole moment with geometry of molecules	R, U	PSO11

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Thermodynamics I**	**9**	
1.1	Types of processes, zeroth law of thermodynamics.	1	1
1.2	Definition of internal energy and enthalpy Heat capacities at constant volume (Cv) and at constant pressure (Cp), relationship between Cp and Cv.	1	2
1.3	First law of thermodynamics, mathematical form, (numerical problems)	1	2
1.4	Reversible process and maximum work. Calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic condition. (numerical problems)	2	2
1.5	The Joule-Thomson effect – isoenthalpic process, Joule-Thomson coefficient, derivation of the expression for Joule-Thomson coefficient. Sign and magnitude, inversion temperature-in terms of van der waal's constant.	1	2
1.6	Thermochemistry – Standard state. Standard enthalpies of reactions: Enthalpies of formation, combustion and neutralization. Enthalpies of solution -Integral and differential enthalpies of solution. Hess's law and its applications. Kirchoff's equations.	3	2
2	**Thermodynamics II**	**9**	
2.1	Limitations of Ist Law, Need for IInd law of thermodynamics. Spontaneous process.	1	3

2.2	Carnot cycle:-net work done and efficiency of Carnot engine, Carnot theorem. Different statements of IInd law	2	3
2.3	Thermodynamic scale of temperature Concept of entropy- Definition and physical significance. Entropy as a function of volume and temperature, pressure and temperature, as a criterion of spontaneity and equilibrium. Entropy changes in reversible and irreversible processes. Entropy change accompanying change of phase, solid to liquid, liquid to vapour, one crystalline form to another	2	3
2.4	Free energy: Gibbs and Helmholtz free energies and their significances - criteria of thermodynamic equilibrium and spontaneity. Gibbs-Helmholtz equation, dependence of Gibbs free energy changes on temperature, volume and pressure. Significance of Gibbs-Helmholtz equation.	2	3
2.5	Partial molar quantities. Chemical potential-Gibbs-Duhem equation, Clapeyron – Clausius equation. Concept of fugacity, determination of fugacity by graphical method.	2	3
3	**Thermodynamics III & Statistical thermodynamics**	**12**	
3.1	Nernst heat theorem, proof and its consequences. Statement of IIIrd law-Plank's statement, Lewis Randall statement. Concept of perfect crystal, evaluation of absolute entropies of solid, liquid and gas. Exception to IIIrd law with reference to examples- CO, NO, N_2O and H_2O	5	4
3.2	Statistical thermodynamics: introduction, types of statistics- MB, BE and FD. Ferminons and bosons, Phase space, system, assembly and ensemble-types of ensembles and uses. Thermodynamic probability, Boltzmann distribution law (no derivation). Partition function, molecular partition function for ideal gas	4	4
3.3	Thermodynamic functions in terms of partition functions - internal energy, enthalpy, pressure, work function and free energy function	3	4
4	**Spectroscopy I**	**12**	
4.1	Regions of electromagnetic spectrum. Different units of energy (erg, Joule, calorie, an cm^{-1}, Hz, A^0 and eV) and their interconvertions. Interaction with mater- Quantization of energy- photon,various types of molecular excitation and types of molecular spectra. Born-Oppenheimer approximation.	2	5

4.2	Rotational spectroscopy: Interaction between molecules and microwaves and criteria for microwave activity, rotation of molecules: Types of molecules according to moments of inertia- linear, symmetric top, asymmetric top and spherical top with two examples each. Microwave spectroscopy of rigid diatomic molecules, derivation for $I= \mu r^2$. energy expression, rotational constant,rotational energy levels, selection rule, pure rotational spectra. Separation between spectral lines, equation of J for maximum intensity (no derivation), determination of bond length.	2	5
4.3	Vibrational spectroscopy: Criteria for IR activity, Simple Harmonic oscillator model; Hooks law, energy and frequency equations. IR spectra of diatomic molecules. Energy expression, Selection rules, Zero-point Energy, frequency of separation, calculation of force constant, anharmonic oscillators, Morse equation. Energy expression and Selection rules, Fundamental and overtone transitions. Combination bands. Degree of freedom of polyatomic molecules.	2	5
4.4	Raman spectroscopy: Rayleigh and Raman Scattering, Stoke's and antistoke's lines and their intensity difference. Interaction between molecules and IR radiations and criteria for Raman activity, Induced dipole moment and polarizability, Pure Rotational Raman spectra. Selectionrule. Frequency of separation, vibrational Raman spectra, Selection rule, Rule of Mutual exclusion, (example;CO_2)		5
5	**Spectroscopy II**	**12**	
5.1	Electronic spectroscopy of molecules: Selection rule, Vibrational Coase Structure, Frank-Condon principle-Diagram, spectrum and continuum.	2	6
5.2	Dissociation and dissociation energy, Determination of Dissociation energy (equation only), Predissociation. Electronic spectra of polyatomic molecules (qualitative idea only), Different types of electronic excitations.	2	6
5.3	NMR spectroscopy: Principle of NMR, nuclear spin. H-NMR, Interaction of nuclear spin with external magnet. Energy level splitting, Precession.	2	6
5.4	Chemical shift. Delta and tau scales. Presentation of NMR spectra, Low resolution spectra and high resolution spectra,-Spin-spin coupling	2	6

5.5	Electron spin resonance spectroscopy: Principle, Types of substances with unpaired electrons, interaction of electron magnet with external magnet. Energy level spliting. Lande splitting factor,	2	6
5.6	presentation of ESR spectrum, the normal and derivative spectra. Hyperfine splitting. Simple examples of methyl and benzene radicals.	2	6
6	**Non-spectroscopic methods**	**9**	
6.1	Dipole moment, Debye equation and Clausius-Mosotti equation, measurement of dipole moment by temperature method, Dipole moment and molecular structure.	3	7
6.2	Diamagnetism and paramagnetism, Magnetic susceptibility and unpaired electrons, measurement of magnetic susceptibility,	3	7
6.3	Molar refraction and molecular structure, Atomic refraction, Optical exaltation, Parachor and atomic equivalent of parachor.	3	7
7	**Group theory**	**9**	
7.1	Group theory: Elements of symmetry – Proper and improper axis of symmetry, plane of symmetry, centre of symmetry and identity element. Combination of symmetry elements,	2	8
7.2	Determination of point groups of simple molecules- Acetylene,H2O, NH3, BF3, [Ni(CN)4]2- and C6H6.	2	8
7.3	Symmetry operations. Order of a group. Combination of symmetry operations. Group theoretical rules.	3	8
7.4	Construction of Group multiplication table of C2V.	2	8

Text books

1. B. R Puri,L. R Sharma,M. S.Pathania, Principles of Physical Chemistry,Vishal Publishing Company,
2. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw-Hill Education
3. A. SalahuddinKunju and G. Krishnan, Group Theory and its Applications in Chemistry, PHI Learning Pvt. Ltd
4. Ramakrishnan and M S Gopinathan, Group Theory in Chemistry, Vishal Publishing Co

For Further Reading

1. Gurdeep Raj, “Advanced Physical Chemistry”, Goel Publishing House
2. P W Atkins, “Physical Chemistry”, Oxford University Press
3. Physical Chemistry. Ira N Levine, McGraw Hill
4. R J Silby and R AAlberty, “Physical Chemistry”, John Wiley & Sons
5. S Glasstone, “Thermodynamics for Chemists”, Affiliated East West Publishers
6. G W Castellan, “Physical Chemistry”, Narosa Publishing House

7. M C Guptha, “Elements of Statistical Thermodynamics”, New Age International (P) Ltd.
8. L K Nash, “Elements of Statistical Thermodynamics”, Addison Wesley
9. ManasChanda, “ Atomic structure and Chemical bonding in Molecular Spectroscopy”, Tata McGraw Hill

UNIVERSITY OF KERALA

Model Question Paper of B.Sc. Chemistry Programme

2020 Admission onwards

SEMESTER VI Core Course-X Course Code CH1641 Credit-4

PHYSICAL CHEMISTRY II

Time: 3 Hrs **Total marks: 80**

SECTION A

Answer all the questions. Each question carries 1 mark

1. Which of the following will give pure rotational spectrum, H_2, N_2, CO2 or HCl.
2. Write the mathematical expression of first law of thermodynamics.
3. Which branch of spectroscopy is used for the identification of free radicals?
4. What is the significance of polarizability of a molecule?
5. Give the selection rule in vibrational spectroscopy.
6. State different symmetry elements in molecules.
7. Write the Clausius- Mosotti equation .
8. Differentiate delta and Tau scale.
9. Give the selection rule for rotational spectroscopy.
10. What is the unit of dipole moment?

SECTION B

Answer any 8 questions (Short answer type, 2 marks each),

11. Explain Hess’s law with an example.
12. Derive an expression for Joule Thomson coefficient
13. How will you account for the origin of second law of thermodynamics?
14. How will you correlate dipolemoment with geometry of molecules. Explain with two examples.
15. Discuss on symmetric top and asymmetric top molecules.
16. State mutual exclusion principle with an example.

17 What is meant by normal modes of vibrations?
18. Explain predissociation with diagram.
19. Calculate the number of fundamental modes of vibrations of CO_2 and SO_2 molecules.
20. How does stokes and anti stokes lines originate in Raman spectrum.
21. What do you mean by the term 'parachor'
22. Explain Chemical shift.

SECTION C

Each question carries 4 marks (Short essay), Answer any 6 questions

23. What is an ensemble, explain the different types of ensembles.
24. Discuss the calcualation of workdone in irreversible expansion of an ideal gas under isothermal and adiabatic condition.
25. State and prove Nernst heat theorem. What are its consequences?
26. What is meant by Optical Exaltation? Calculate the optical exaltation of 2,6-dimethylhepta-2,5-dien-4-one.
27. Compare principle of NMR and ESR.
28. Explain the following terms Entropy and free energy. Explain why $T\Delta S$ determine randomness of a system?
29. Give an account of intensive and extensive properties.
30. Explain mutual exclusion rule with examples.
31. The fundamental vibrational frequency of carbon monoxide molecule is 2170. cm^{-1} Calculate the force constant of the molecule.

SECTION D

Answer any two question , 15 marks each

32. a) What is meant by reversible process? Derive an expression for work done in the reversible isothermal expansion of an ideal gas. (5 marks)

b) Calculate the work done in expanding one mole of an ideal gas from a volume of 2 to 20 dm^3 at 27 ^0C (5 marks)

c) Derive the relation between Cp and Cv. (5 marks)

33. a) Give an account of different statistical approaches (6 marks)

b) Show that for a rigid diatomic rotor, the moment of inertia is given by $I = \mu r^2$

c) The pure rotational spectrum of a gaseous molecule CN consists of a series of equally spaced lines

separated by 3.7978cm^{-1}. Calculate the internuclear distance of the molecule. The molar masses are;

^{12}C=12.011 and ^{14}N=14.007 g mol^{-1}.

34. a) How can NMR spectrum distinguish between the isomers: p-xylene and ethyl benzene?

b) Explain the shielding and deshielding mechanism in NMR.

c) Give the hyperfine structure of ESR spectrum of hydrogen atom. Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33T. Given ge = 2 and μB = 9.273x10-24 JT^{-1}.

35. a) Discusson order of a group (5 marks)

b) Explain Frank Condon principle with diagram. (5 marks)

c) Draw the group multiplication table of C2vpoint group (5 marks)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	VI
Course	Core course-XI
Course name	**ORGANIC CHEMISTRY III**
Course Code	CH 1642
Credit	4
Hours	72 hours
Lecture-Tutorial-Lab	3-0-2

CO No.	**COURSE OUTCOMES** *Upon completion of this course, the students*	**Cognitive Level**	**PSO No.**
1	Outline the chemistry of simple heterocyclic compounds	U	PSO10
2	Classify amino acids, proteins, nucleic acids, drugs, terpenes, vitamins, lipids and polymers.	U	PSO10
3	Discuss the synthesis of amino acids, peptides, drugs and polymers.	U	PSO9
4	Describe the isolation and structure of terpenes and alkaloids.	R	PSO10
5	Explain the mechanism and techniques of polymerisation.	U	PSO11

6	Discuss the principle of UV, IR, NMR and Mass spectroscopy.	U	PSO2
7	Interpret spectroscopic data to elucidate the structure of simple organic compounds.	A	PSO18
8	Use the simple organic reactions to elucidate the structure of quinoline, piperine and conine.	A	PSO18

R-Remember, U-Understand, A-Apply.

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Heterocyclic compounds and Drugs**	**9**	
1.1	Heterocyclic compounds- classification,nomenclature, aromaticity. Basicity of pyridine and pyrrole.	1	1
1.2	Preparation - Paal-Knor synthesis and Hantzsch synthesis. Properties of furan, pyrrole, thiophene and pyridine.	2	1
1.3	Synthesis and reactions of quinoline, isoquinoline and indole with special reference to Skraup, Bischler-Napieralski and Fischer-Indole synthesis.	2	1
1.4	Structural elucidation of quinoline. Structure of purine and pyrimidine bases.	1	1,8
1.5	Drugs – introduction – classification on the basis of application	1	2
1.6	Synthesis and use of sulphanilamide, sulphathiazole,sulphapyridine, paracetamol and aspirin. Mode of action of sulphadrugs and amphicillin. Elementary idea of the structure and application of chloroquine, ibrufen and phenobarbitol.	2	3
2	**Amino acids, proteins and nucleic acids**	**9**	
2.1	Amino acids – classification, structure and stereochemistry of amino acids,	2	2
2.2	Essential and non essential amino acids – zwitter ion, isoelectric point.	1	2
2.3	Synthesis of amino acids – Strecker synthesis, Gabriel phthalimide synthesis, Erlenmeyer azlactone synthesis. Peptides: Structure and synthesis (Carbobenzoxy, Sheehan and solid phase synthesis)	2	3
2.4	Proteins – classification of proteins – structure of proteins – denaturation and colour reactions.	2	2
2.5	Nucleic acids: Classification, structure of DNA and RNA. Replication of DNA. Transcription and Translation - Genetic code.	2	2
3	**Natural products**	**9**	
3.1	Terpenes – Classification - Isoprene rule - Essential oil – Source	1	2,4
3.2	Structure (no structural elucidation) and uses of citral, geraniol, limonene and menthol. Structure of natural rubber – vulcanization and its advantages.	1	4

3.3	Alkaloids – Extraction. Structure and importance of nicotine, quinine, morphine and codeine.	2	4
3.4	Structural elucidation of piperine and conine.	2	8
3.5	Vitamins : Classification, structure, functions and deficiency diseases (structure of vitamin A, B1 and C only - no structural elucidation).	1	2
3.6	Lipids – biological functions – oils and fats - Common fatty acids	1	2
3.7	Hydrogenation, rancidity, saponification value, iodine value and acid value.	1	2
4	**Soaps, Detergents and Polymers**	**9**	
4.1	Soaps and detergents: Soap – synthetic detergents – cleaning action of soap and detergents.	1	2
4.2	Polymers: General idea of monomers, polymers and polymerisation	1	2
4.3	Degree of polymerisation – polydispersity - number and weight average molecular mass.	1	2
4.4	Classification of polymers, Homopolymers and copolymers, Addition and condensation polymers, thermoplatstics and thermosets	1	2
4.5	Mechanism of addition polymerization (Cationic, anionic and free radical)	1	5
4.6	Coordination polymerization - Ziegler Natta catalyst - Tacticity in polypropylene.	1	2
4.7	Polymerisation techniques – Bulk, solution and emulsion polymerization (Elementary idea)	1	5
4.8	Addition polymerization- Preparation and uses of (i) polyethylene (ii) PVC (iii) Teflon Condensation polymerization - (i) phenol-formaldehyde resin (ii) epoxy resin (iii) nylon-66 (iv) polyethylene terephthalate.	1	2
4.9	Synthetic rubbers – SBR and nitrile rubbers. Additives to polymers – Plasticisers, stabilizers and fillers. Biodegradable polymers (Basic idea only).	1	2
5	**Organic Spectroscopy I**	**9**	
5.1	UV–Visible spectroscopy – Beer-Lambert's law, types of electronic transitions, bathochromic, hypsochromic shifts, hyperchromic and hypochromic effects.	2	6
5.2	UV-Visible spectra of enes, effect of conjugation – solvent effect - Calculation of λmax of dienes and α,β-unsaturated ketones.	2	6
5.3	IR spectroscopy – Molecular vibrations, Functional group and finger print region – group frequencies, effect of hydrogen bonding on –OH stretching frequency.	3	6
5.4	Factors influencing carbonyl stretching frequency. Comparison of carbonyl stretching frequency in compounds containing carbonyl group.	1	6
5.5	Interpretation of IR spectra of simple organic molecules such as	1	7

	salicylaldehyde, benzamide, acetophenone, nitro benzoic acid and phenyl acetate.		
6	**Organic Spectroscopy II**	**9**	
6.1	NMR spectroscopy – principle of proton NMR, shielding and deshielding effect.	2	6
6.2	chemical shift, factors influencing chemical shift	1	6
6.3	spin-spin splitting, coupling constant, interpretation of PMR spectrum of simple molecules like $CHBr_2CH_2Br$, ethylbromide, pure ethanol and impure ethanol (acidic impurities) acetaldehyde and toluene. Introduction to ^{13}C NMR	3	6
6.4	Structural elucidation of simple organic molecules using IR and NMR spectroscopic techniques.	1	7
6.5	Theory of Mass spectrometry – mass spectrum, base peak and molecular ion peak, types of fragmentation, McLafferty rearrangement, isotopic effect.	2	6

Textbooks:

1. A.Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand& Company, New Delhi.
2. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi..
3. S.C.Sharma and M.K.Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi..
4. I L Finar, "Organic Chemistry" Vol – 1&2, 5th Edition, Pearson Education, New Delhi.
5. Gowariker V.R., Viswanathan N.V. and Jayader Sreedhar, Polymer Science, Wiley Eastern Ltd, New Delhi.
6. O.P.Agarwal, Chemistry of Natural Products, Goel Publications.
7. T.L.Gilchrist, Heterocyclic Chemistry, Pearson Education, New Delhi.
8. Y.R.Sharma, Elementary Organic Spectroscopy, Pearson Education, New Delhi.
9. William Kemp, Organic Spectroscopy, Macmillan, New York.
10. AshuthoshKar, Medicinal Chemistry, New Age International Publishers.

For Further Reading:

1. R.T.Morrison, R.N.Boyd. Organic Chemistry, Pearson Education, New Delhi.
2. P.Y.Bruice, Essential Organic Chemisty, Pearson Education, New Delhi.
3. J.Clayden, N.Greeves and S.Warren, Organic Chemistry, Oxford University Press, New York.
4. Billmeyer F.W., Text book of Polymer Science, John Wiley and Sons.
5. S.P.Bhutani, Chemistry of Biomolecules, Ane Book Pvt Ltd.
6. R.M.Silverstein and F.X.Webster, Spectrometric Identification of Organic Compounds, John Wiely and Sons, New York.
7. P.S.Kalsi, Application of Spectroscopic Techniques in OrganicChemistry, NewAge International, New Delhi.

UNIVERSITY OF KERALA

Model Question Paper of B.Sc. Chemistry Programme

2020 Admission onwards

SEMESTER- VI Core Course XI Course Code CH1642 Credit 4

ORGANIC CHEMISTRY III

Time:3hours Max.Marks: 80

SECTION – A

*(Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **one** mark)*

1. Write the IUPAC name of (i) Furan and (ii) quinoline.
2. Draw the structure of chloroquine.
3. What is isoelectric point?
4. What is natural rubber chemically?
5. Write any two biological functions of lipids.
6. What is soap?
7. Identify the types of electronic transitions in CH_3CHO.
8. What is base peak?
9. Write the monomers of the following polymers (i) PTFE (ii) PP.
10. What is SBR?

(10 X 1 =10 Marks)

SECTION - B

(*Short answer type. Answer **any 8** questions from the following.**Each** question carries **two** marks.)*

11. Compare the aromaticity of furan and thiophene.
12. Write the structure of pyramidine bases present in nucleic acids.
13. Define the terms (i) saponification value and (ii) iodine value.
14. What is isoprene rule?
15. What are essential and non-essential amino acids?
16. What is denaturation of protein?
17. Differentiate oils and fats.
18. Define the terms M_n and M_w
19. What is vulcanisation?
20. What are plastisizers?
21. Differentiate bathochromic and hypochromic shifts.
22. What is TMS? Why it is selected as a reference compound in ^{1}H-nmr spectroscopy?

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer**any 6**questions from the following.**Each**question carries**four**marks.)*

23. Explain the synthesis of amino acid by (i) Strecker and Erlenmeyer azlactone synthesis.
24. What are vitamins? How are they classified? Write the structure of Vitamin A and C.
25. What is tacticity? Explain it by taking poly propylene as an example.
26. What is Bakelite? How is it prepared? Give its important applications.
27. Write a short note on the structure of DNA.
28. Discuss the classification of drugs on the basis of application.
29. Elucidate the structure of conine.
30. (i) How can you distinguish inter and intra molecular hydrogen bonding using IRspectroscopy?
    (ii) Predict the regions where salicylaldehyde give IR absoptions.
31. Explain spin-spin coupling in 1,1,2-tribromo ethane and draw the ^{1}HNMR spectrum of it.

(6 X 4 =24marks)

SECTION – D

(*Answer**any2**question. Each question carries 15 marks*)

32. (a) Discuss the Woodward-Fieser rule for calculating λ_{max} of dienes.
    (b) Explain the principle of nmr spectroscopy.
    (c) A compound with molecular formula C_8H_8O shows the following absorptions:
    (i) IR Spectrum: 3050, 2950, 1700, 1620, 1550, 690 cm^{-1}.
    (ii) pmr spectrum: δ 7-8ppm (multiplet, 5H), 2.5ppm (singlet, 3H).
    Identify the structure of the compound. (5+5+5)
33. (a) Explain the Fischer-Indole synthesis.
    (b) What are sulphadrugs? Give examples. Explain the mode of action of sulphadrugs.
    (c) What are terpenes? How are they classified? Write the structure and uses of limonene
    and menthol. (5+5+5)
34. Write brief note on the following :
    (a) Replication of DNA
    (b) Merrifield synthesis
    (c) Structure of protein (5+5+5)
35. (a) Discuss on the factors influencing chemical shift in NMR spectroscopy.
    (b) Write brief note on the isotopic effect in mass spectroscopy.
    (c) Explain the mechanism of cationic and anionic polymerization. (7+4+4)

(15 X 2 = 30marks)

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	V
Course	Core course-XII
Course name	**PHYSICAL CHEMISTRY III**
Course Code	CH 1643
Credit	4
Hours	72 hours
Lecture-Tutorial-Lab	4-0-2

CO No.	**COURSE OUTCOMES** *Upon completion of this course, the students*	**Cognitive Level**	**PSO**
1	Recall the basic physical concepts in quantum mechanics, colloids, adsorption, Chemical Kinetics, catalysis, chemical and ionic equilibria, phase equilibria, binary liquid systems and photochemistry	R	PSO4
2	Understand the basic concepts involved in quantum mechanics, colloids, adsorption, Chemical Kinetics, catalysis, chemical and ionic equilibria, phase equilibria, binary liquid systems and photochemistry	U	PSO4
3	Derive and Interpret important theories and equations involved in physical chemistry	A	PSO10
4	Demonstrate the origin of quantum numbers by correlating the Cartesian and spherical polar coordinates of hydrogen atom.	A	PSO10
5	Identify and recognize the applications of various principles, equations andphysical processes	U	PSO10
6	Perform calculations involving physical concepts and equations	A	PSO4
7	Analyze` graphical representations (phase diagrams, two and three components, vapour pressure – composition and boiling point –composition, temperature-composition) present in physical chemistry.	A	PSO9
8	Understand terminology	U	PSO11

9	Understand the effects of external influence on various chemical processes	U	PSO1
10	Understand different laws and principles of physical chemistry	U	PSO3

MODULE	**COURSE DESCRIPTION**	**Hrs**	CO number
1	**Quantum mechanics**	**12**	
1.1	Radiation phenomena- blackbody radiation, photoelectric effect, Compton effect and atomic spectra. Plank’s quantum theory and explanation of the radiation phenomena.	2	1,2,6
1.2	Schrodinger wave equation – significance of Ψ, well behaved functions, Concept of operators and some operators of interest , Laplacian and Hermitian (properties of operators not required), Postulates of quantum mechanics	3.5	1,2,5
1.3	Application of quantum mechanics to simple systems - particle in 1 D box, normalization of wave function, Particle in 3 D box. Concept of degeneracy	3.5	1,2,3,5,6
1.4	Application to hydrogen atom (no derivation) Schrodinger wave equation in Cartesian and spherical polar co-ordinates, Quantum numbers.	3	4
2	**Colloids and Adsorption**	**12**	
2.1	Colloidal state: Classification of colloids- Kinetic, optical and electrical properties of colloids.	1	1,2
2.2	Purification of colloids – ultra filtration and electrodialysis,	1	1,2
2.3	Ultra microscope, Electrical double layer and zeta potential.Coagulation of colloids, Hardy-Schulz rule, Gold number.sedimentation and streaming potential	2	1,2
2.4	Gels: Elastic and non-elastic gels, Imbibition and syneresis, Micelles and critical micelle concentration	2	1,2
2.5	Application of colloids – Cottrell precipitator, purification of water and delta formation.	1	1,2
2.6	Adsorption: Physical and chemical adsorption, Freundlich adsorption isotherm, ,	2	1,2
2.7	Derivation of Langmuir adsorption isotherm, Statement and explanation of BET and Gibbs isotherms	2	1,2,3
2.8	Determination of surface area of adsorbents by BET equation. Applications of adsorption	1	1,2,5,6

3	**Chemical Kinetics &Catalysis**	**12**	
3.1	Order of reaction, Derivation of integrated rate equation of zero, first, second and nth order reaction	2	1,2,3,6
3.2	Determination of order of reactions:- Graphical and analytical methods using integrated rate equations, Fractional life- method, Differential rate equation method, Isolation method.	2	1,2,6,7
3.3	Qualitative idea of Complex reactions:- (a) opposing reactions (b) first order consecutive reactions (c) parallel reactions. Qualitative idea of chain reactions.	1.5	1,2
3.4	Influence of temperature on rate of reaction: Arrhenius equation, Determination of Arrhenius parameter, Energy of activation and its significance.	2.5	1,2,3,6,9
3.5	Collision theory, Derivation of the rate equation for a second order reaction based on collision theory, unimolecular reactions- Lindemann mechanism, steady state approximation.	2	1,2,3,10
3.6	Catalysis:- Theories of catalysis, Intermediate compound formation theory, steady state method	1	1,2,10
3.7	Enzyme catalysis, Michaelis-Menten law.	1	1,2,3,10
4	**Chemical and Ionic Equilibria**	**12**	
4.1	Equilibrium constant and free energy	1	1,2,6
4.2	Thermodynamic derivation of law of mass action, relation between Kp,Kc and Kx	1	1,2,3
4.3	Le-Chatelier'sPrinciple – Application in Haber process and dissociation of PCl_5	1	1,2,3,5,9,10
4.4	Reaction isotherm, Temperature dependence of equilibrium constant, Pressure dependence of equilibrium constant	2	1,2,9
4.5	Application of Clausius-clapeyron equation in physical equilibria.	2	1,2,3,5,6
4.6	Ionic equilibrium : Ionic product of water, Effects of solvents on ionic strength, levelling effect,	1	1,2,5,6,8
4.7	pKa and pKb values, solubility product and common ion effect and their applications	1	1,2,3,5,6,8
4.8	pH and its determination by indicator methods, buffer solution, buffer action, Henderson's equation, buffer capacity	1	1,2,3,5,6,8
4.9	hydrolysis of salts of all types, degree of hydrolysis and hydrolytic constant, determination of degree of hydrolysis, relation between hydrolytic constant and ionic product of water	2	1,2,3,6,8

5	**Phase Equilibria**	**12**	
5.1	Phase Equilibria:-Terminology, the phase rule, thermodynamic derivation of phase rule	1	1,2,3,6,8
5.2	application to (a) water system (b) sulphur system (c) solid-liquid equilibria involving simple eutectic system such as Pb-Ag system, KI-water system	3	1,2,6,7
5.3	application to solid-liquid equilibria involving simple eutectic system such as Pb-Ag system, KI-water system	2	1,2,6,7
5.4	freezing mixtures, thermal analysis and desilverisation of lead	1	1,2,7,8
5.5	solid-liquid equilibria involving compound formation with congruent and incongruent melting points:- $FeCl_3$-H_2O system and Na_2SO_4-H_2O system	3	1,2,6,7,8
	solid–gas system- decomposition of $CaCO_3$, dehydration of $CuSO_4.5H_2O$, deliquescence and efflorescence.	2	1,2,6,7,8
6	**Binary Liquid Systems**	**9**	
6.1	Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures,	1	1,2
	Raoult’s law, vapour pressure- composition, temperature-composition curves	2	1,2,5,7,10
6.2	fractional distillation, deviation from Raoult’s law	1	1,2,5,8
6.3	Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST	2	1,2,5,8
6.4	Introduction to three component system, distribution law, its thermodynamic derivation, limitations of distribution law.	2	1,2,3,5,10
6.5	Application of distribution law to the study of association and dissociation of molecules	1	1,2,5,6
7	**Photochemistry**	**3**	
7.1	Grothus-Draper, Beer- Lambert and Stark- Einstein laws.	1	1,2,6,10
7.2	Quantum yield, Reason for very low and very high quantum yields, Rate equation for decomposition of hydrogen iodide, Qualitative treatment of H_2-Cl_2 reaction and H_2-Br_2 reaction	1	1,2,9
7.3	Fluorescence and phosphorescence, chemiluminescence and photosensitization, Explanation and examples	1	1,2,5,8

Textbooks

1. Puri, Sharma & Pathania, Priniciples of Physical Chemistry, Vishal Publishing Co
2. Elements of Physical Chemistry , Glasstone and Lewis,Macmillan
3. ,P.C.Rakhit, Physical Chemistry,Sarat Book House,Calcutta
4. I N Levine, Quantum Chemistry, Prentice Hall

5.RL Madan ,Physical Chemistry, Mc Graw Hill

For Further Reading

1.R J Selby and RA Alberty, Physical Chemistry,John Wiley &sons
2. Levin, Physical Chemistry , 5th edn ,TMH
3 Bahl, Arun Bahlan dG D Tuli,Essentials of Physical Chemistry , S Chand Ltd
4. S.C.Anand, A text book of Physical Chemistry, New Age International publishers.
5.Gurdeep Raj, Advanced Physical Chemistry, Goel publishing house

UNIVERSITY OF KERALA
Model Question Paper of B.Sc. Chemistry Programme
2020 admissions onwards
SEMESTER VI Core Course XII: Course Code CH1643 Credit 4
PHYSICAL CHEMISTRY – III

Time: 3 Hrs **Total marks: 80**

SECTION A

Answer all the questions Each question carries 1 mark

1. Name two quantum mechanical operators
2. Give the Arrhenius equation.
3. Write the integrated rate equation for a first order reaction.
4. Give the relation between hydrolytic constant, dissociation constant and ionic product of water of a salt of strong acid and weak base.
5. The solubility of AgCl in water at 250C is 0.00179 g/L. calculate its solubility product at 25 ^{0}C.
6. Write Debye- Huckel- Onsagar equation.
7. Write the reduced phase rule equation.
8. Give an example for a system having upper cum lower CST.
9. Give the Nernst equation for the potential of a copper electrode.
10. What is meant by quantum yield of a photochemical reaction?

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SECTION B

Each question carries 2 marks (Short answer) **.** Answer any **8** questions

11. Explain an eigen function with an example.
12. Give the normalization condition of a wave function.
13. Give one example each for an acidic and a basic buffer.
14. Define buffer solution and buffer index
15. Define the term activation energy. Why different reactions proceed at different rates?
16. What is meant by common ion effect? Explain with an example.
17. Describe with example (i) Triple point (ii) Eutectic point
18. Explain the term congruent melting point with an example
19 Write a note on ionic product of water
20. Differentiate between pKa and pKb values.
21. How will you characterise the triple point of water?
22. What is meant by phosphorescence?

SECTION C

Answer any 6 questions. Each question carries 4 marks (Short essay).

23. Discuss postulates of quantum mechanics
24. The rate constant of a second order reaction is 5.70 x $10^{-5} dm^3 mol^{-1} S^{-1}$ at 25^0C and 1.64 x $10^{-4} dm^3 mol^{-1} S^1$ at 40^0C. Calculate the activation energy and the Arrhenius preexponential factor
25. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 500 ml? Dissociation constant of acetic acid at 250C is 1.75 x 10^{-5}.
26. Explain the principle of freezing mixture by taking KI – H2O system as an example
27. State and explain Nernst distribution law. What are the limitations of the law?
28. Write notes on ultra filtration and electrodialysis.
29. Discuss on a consecutive and a parallel reactions with examples
30. What are the laws of photochemistry , explain ?
31. Explain the phase diagram of Pb-Ag system

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SECTION D

Each question carries 15 marks ,Answer any two questions

32. a) using Le Chatliers Principle, describe the effect of temperature, pressure and concentration for the following systems in equilibria:
    1) Formation of $NH_{3(g)}$ from $N_{2\,(g)}$and $H_{2(g)}$
    2) Dissociation of $PCl_{5(g)}$ in to $PCl_{3(g)}$ and $Cl_{2(g)}$ (6 marks)

    b)Derive the rate equation for a second order reaction based on collision theory. (4 marks)
33. a)What is critical solution temperature? How does it vary by the addition of an

electrolyte?

((5 marks)

b) What is meant by CST. Explain different types of CST with examples (6 marks)

c) Elaborate on azeotropic mixtures with examples (4 marks)

34. a)Derive van't Hoff equation for temperature dependence of equilibrium constant

b)The equilibrium constant for a reaction is 1× 105. Calculate the standard free energy change for the reaction in kilojoules at 25? C.

c) The half life of a first order reaction is 50 min. Calcualate the time required to reduce the initial concentration to 12.5%. (5x3=15 marks)

35. a) Write note on (i) Fluorescence (ii) Chemiluminescence (5 marks)

b) Derive Langmuir adsorption isotherm (5 marks)

c) Explain the phase diagram of water (5 marks)

UNIVERSITY OF KRALA

SYLLABUS FOR B.Sc. CHEMISTRY

FIRST DEGREE PROGRAMME

2020 Admission onwards

LAB COURSES

(For all Lab courses scheme of ESE is decided by the board of examiners in each year)

Computer Lab for

Foundation Course II (CH 1221) SEMESTER II

(No ESE)

Semester	II
Hours	2 hours/week
Lecture-Tutorial-Lab	0-0-2

CO No.	COURSE OUTCOME *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Get acquainted with Computer Lab based instruction on the use of computer and internet in learning.	U	PSO5
2	Use of educational softwares, information mining from internet and using INFLIBNET/NICNET, NPTEL and VIRTUAL LABS OF MHRD.	A	PSO5
3	Learn Word processing and document preparation. Use of Spread sheets in Data handling and presentation	U	PSO5
4	Develop skill in chemical structure drawing and visualization of molecules using chemistry softwares	U	PSO5

Students should submit the following documents, certified by Teacher in charge, along with LAB COURSE I records for ESE

1. Structure of any five simple organic molecules using Chem Sketch or Chemdraw

2. Any five chemistry related graphical plots using Excel

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SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards
Core Course-II
LAB COURSE I
INORGANIC QUALITATVE ANALYSIS
(ESE at IV Semester)

Time 3Hrs **Marks 80**

Semester	I,III &IV
Course	**Core Course-IV, Lab Course I**
Course name	**Inorganic Qualitative Analysis**
Course Code	**CH1442**
Credit	2
Hours	2 hours/week
Lecture-Tutorial-Lab	0-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**	**PSO No.**
1	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	U	PSO1
2	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	A	PSO2/ PSO8
3	Use glass wares ,electric oven, burners and weighing balance	A	PSO1
4	Develop skill in observation , prediction and interpretation of reactions	A	PSO1
5	Detect solubility, and classify compounds according to their solubility	U	PSO3
6	Apply the principle of common ion effect and solubility	A	PSO1&

	product in the identification and separation of ions		PSO2
7	Develop skill in preparing and purifying inorganic complex compounds	A	
8	Use filtration and chomatographic techniques, vacuum pump and centrifugal pumps	U	PSO4

MODULE	COURSE DESCRIPTION	Hrs	CO No.
I	**Lab Safety Measures**	**36**	1
A	***General Instructions***	**10**	
1	Readiness to follow Laboratory rules and regulations and cooperating with Lab instructors and staff for avoiding accidents	2	
2	Laboratory safety measures, develop safety skills by wearing lab coats, gloves and safety eye glasses wherever necessary (Necessity of **FIRST AID** and of keeping first Aid box in Lab)	2	
3	Procedures adopted in chemical splashes to skin, eyes, burns and electric shock, Instruction for emergency use of **Fire extinguishers in Lab**	2	
4	Labels and warning symbols for Safe handling of Toxic and corrosive chemicals	4	
B	***Experimental and scientific Skills***	**26**	3,4
1	Preparation of solution, Precipitation, Dissolution, Crystallisation techniques	4	
2	Use of Bunsen Burner, Electric Burners , advantages and disadvantages -Ignition tests,Flame tests and ash tests for detection of cations and anions	4	
3	Filtration techniques-Filter paper, Electric Centrifuge, Vacuum pump	2	
4	Purification technique-Washing of precipitates,Re-crystallsation and drying of precipitate	4	
5	Writing experimental procedures	2	
6	Reporting, Tabulation of data,Use of Lab records	2	
7	Semimicro analysis and Microanalysis, advantages and disadvantages		
8	Application of common ion effect in precipitation and separation of ions	4	
9	Inter group separation techniques	4	

II	**Qualitative Inorganic Analysis (Micro Analysis)**	**48**	4,5, 6
1	Studies of the reactions of the following basic radicals with a view to their identification and confirmation: Lead, Copper, Bismuth, Cadmium, Tin, Antimony, Ferrous, Ferric ions, Aluminium, Chromium, Zinc,Manganese,Cobalt,Nickel,Calcium,Strontium,Barium,Magnesium , Potassium and Ammonium ions/radicals	12	
2	Studies of the reactions of the following acid radicals with a view to their identification and confirmation: Carbonate, Sulphide, Nitrite, Nitrate, Fluoride, Chloride, Bromide, Iodide , Borate, Acetate, Oxalate, Chromate, Phosphate and Sulphate anions.	12	
3	Systematic qualitative analysis by **microscale methods** of salt mixtures containing two acidic and two basic radicals from the above list (more than one interfering radical should be avoided).	30	
III	**Inorganic Preparations** Preparations of i)Potash alum ii) Hexamine cobalt Chloride iii) Tetramine copper Sulphate iv) Mohr's salt v) Microcosmic salt vi) Sodium cobalti nitrate vii) Sodium nitro prusside vii) Manganese phthalocyanin ix) Potassium trioxalatochromate x) Potassium trioxalatoferrate	**20**	4,5, 6
IV	**Introduction to Chromatographic Separation techniques (No ESE)**	**4**	8
1	Demonstration of Paper chromatography	2	
2	Demonstration of Thin layer chromatography	2	

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2020 Admission onwards
SEMESTER V
Core Course-VIII
LAB COURSE II
INORGANIC VOLUMETRIC ANALYSIS
(ESE at V Semester)

Time 3Hrs **Marks 80**

Semester	V
Course	Core Course-VIII, Lab Course II
Course name	**INORGANIC VOLUMETRIC ANALYSIS**
Course Code	**CH1544**
Credit	3
Hours	5 hours/week (90Hrs)
Lecture-Tutorial-Lab	0-0-5

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Develop skill in selecting, primary and secondary standards	U	PSO1
2	Develop skill in weight calculation of primary standards weighing by electronic balance, making of solutions of definite strength (standard solutions)	A	PSO2 PSO8
3	Use sophisticated glass wares, calibrate apparatus and develop skill in keen observation , prediction and interpretation of results	A	PSO1
4	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A	
5	Compare the advantages and disadvantages of different volumetric techniques	U	
6	Practice Punctuality and regularity in doing experiments and submitting Lab records	A	

MODULE	COURSE DESCRIPTION	Hrs	CO No.
I	**Preparation of standard solutions**	**6**	
1	Calculation of mass of a primary standard substance and preparing its standard solution (use of constant boiling hydrochloric acid and Analytical Grade Reagents is recommended)	**2**	
2	Preparation of a solution of definite strength by Dilution techniques	**2**	
3	Preparation of carbonate free sodium hydroxide.	**2**	
II	**Inorganic Volumetric analysis-(one burette titration)**		
(a)	***Acidimetry and alkalimetry***	**25**	
1	Standardisation of HCl using Analytical Grade Na_2CO_3	**3**	
2	Titrations of Strong acid (HCl, HNO_3 and H_2SO_4) by strong bases (NaOH, KOH)	**8**	
3	Strong base (NaOH, KOH)– weak acid (Oxalic acid)	**5**	
4	Strong acid –(HCl, HNO_3 or H_2SO_4) by weak base (Na_2CO_3 solution)	**5**	
5	Determination of Na_2CO_3 and $NaHCO_3$ in a mixture by indicator method	**2**	
6	Estimation of NH_3 in an ammonium salt by direct and indirect methods	**2**	
(b)	***Permanganometry***	24	
1	*Standardisation of Potassium permanganate using A.R Oxalic acid/Mohr's salt*	3	
2	Estimation of Ferrous iron	3	
3	Estimation of Oxalic acid	3	
4	Estimation of Hydrogen peroxide	3	
5	Estimation of Calcium	4	
6	Estimation of Nitrite	3	
7	Estimation of MnO_2 in pyrolusite	5	
(c)	***Dichrometry***	*9*	
1	Determination of Ferrous iron using internal & external indicator	4	
2	Determination of Ferric iron after reduction with $SnCl_2$.	5	
(*d*)	***Cerimetry***	4	
1	Standardisation of ceric ammonium sulphate with Mohr's salt.	2	
2	Determination of oxalic acid using ceric ammonium sulphate.	2	
(e)	***Iodimetry &Iodometry***	**9**	
1	Standardisation of thiosulphate using KIO_3	3	
2	Standardisation of iodine using thiosulphate	3	
3	Determination of copper in copper sulphate	3	
(f)	*Precipitation titration*	*3*	
	Determination of chloride in neutral medium	3	

(g)	***Complexometry***	*10*	
1	Standardisation of EDTA solution with $ZnSO_4$	3	
2	Determination of Zinc, using EDTA	2	
3	Determination of Magnesium	2	
4	Determination of permanent and temporary hardness of water using standardized EDTA	3	

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2020 Admission onwards
LAB COURSE III

PHYSICAL CHEMISTRY EXPERIMENTS

(ESE at V Semester)

Time 3Hrs

Marks 80

Instructions for use of computer softwares and programmes in the physical chemistry experiments

1.Computer software (Excel) is to be used for plotting graph or calculations.
2. Spread sheet program can be used for determining Equivalence point in potentiometric and conductometric titrations .
3. Data analysis of kinetic experiments using spreadsheet program (determination of rate constant)
4.Plot scatter diagram (wherever applicable in physical experiments)

Semester	V
Course	Core Course-IX, Lab Course III
Course name	**PHYSICAL CHEMISTRY EXPERIMENTS**
Course Code	**CH1545**
Credit	2
Hours	4 hours/week (72Hrs)
Lecture-Tutorial-Lab	0-0-4

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Develop Scientific outlook and approach in applying principles of physical chemistry in chemical systems/reactions	U	PSO1
2	Use computational methods for plotting graph	A	PSO2/PSO8

3	Desribe systematic procedures for physical experiments	U	PSO1
4	Acquire Instrumentation skill in using conductometer, potentiometer, refractometer, stalagmometer and Ostwald's viscometer.	U	PSO3
5	Compare theory with experimental findings	A	PSO1& PSO2
6	Practice Punctuality and regularity in doing experiments and submitting Lab records	A	

MODULE	**COURSE DESCRIPTION**	**Hrs**	CO No.
I	**Conductometry**	**12**	1-7
1	Determination of cell constant		
2	Conductometric titration of NaOH using HCl		
II	**Potentiometry**	**8**	1-7
1	Potentiometric titration of Fe^{2+} *versus* $Cr_2O_7^{2-}$		
2	Potentiometric titration of $KMnO_4$ *versus* KI		
3	Potentiometric titration of HCl *versus* NaOH using quinhydrone electrode		
III	**Phenol-water (Binary liquid systems)**	**12**	1-7
1	Critical solution temperature of phenol –water system		
2	Influence of KCl(impurity) on the miscibility temperature of phenol-water system .Determination of concentration of given KCl solution		
IV	**Transition temperature depression methods**	**12**	1-7
1	Determination of transition temperature of a salt hydrate.		
	Determination of Kt of salt hydrate		
2	Determination molar mass of a solute using transition point depression method		
V	**Kinetics**	**4**	1-7
	Kinetics of hydrolysis of an ester (methyl acetate/ ethyl acetate)		
VI	**Surface tension**	**4**	1-7
1	Determination of Surface tension of any three liquids		
2	Surface tension of binary mixtures and determination of concentration of an unknown mixture		
VII	**Viscosity**	**4**	1-7
1	Determination of viscosity of any three liquids		
2	Viscosity of binary mixtures and determination of concentration of an unknown mixture		
VIII	**Refractice index experiments**	**4**	1-7
1	Determination of refractive indices of any three liquids		
2	Refractive indices of KCl solutions of different concentrations and determination of concentration of unknown KCl solution		
IX	**Heat of neutralization**	**4**	1-7

	Determination of water equivalent of Calorimeter and heat of neutralization of strong acid and strong base		
X	**Partition experiments**	**8**	1-7
	Partition coefficient of iodine between CCl_4 and H_2O or Partition coefficient of ammonia between $CHCl_3$ and H_2O		

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2020 Admission onwards

LAB COURSE IV ORGANIC CHEMISTRY EXPERIMENTS

(ESE at VI Semester)

Time 3Hrs **Marks 80**

Semester	VI
Course	Core Course-XIII, Lab Course IV
Course name	**ORGANIC CHEMISTRY EXPERIMENTS**
Course Code	CH1644
Credit	3
Hours	5 hours/week (90 Hrs)
Lecture-Tutorial-Lab	0-0-5

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Develop curiosity in systematically analyzing organic compounds	A	PSO1
2	Differentiate and identify organic compounds by their characteristic reactions towards standard reagents	U	PSO10
3	Confirm their findings by preparing solid derivatives, and thus understand reliability of experimental results	A	PSO2
4	Determine physical constants of organic compounds	A	PSO3

5	Separate organic compounds by TLC/paper/column chromatographic techniques	A	PSO3
6	Prepare soaps	A	PSO18
7	Apply the principles and techniques in organic chemistry, thereby developing skill in designing an experiment to synthesize and purify organic compounds	A	PSO18
8	Practice systematic scientific procedure and prepare adequate report of them	A	PSO16
9	Understand the chemistry behind organic reactions	A	PSO10

MODULE	COURSE DESCRIPTION	Hrs	CO No.
I	**Detection of Elements**	**3**	
	Lassaign's test for Nitrogen, Sulphur and Halogen		
II	**Solubility Tests**	**5**	2
1	Classification of compounds into water soluble/insoluble		
2	Classification of compounds into ether soluble/insoluble		
3	Solubility in Na_2CO_3		
4	Solubility in NaOH		
5	Solubility in HCl		
III	**Tests for Aliphatic and Aromatic compounds**	**2**	2
	(i)Ignition test (ii)Nitration test		
IV	**Tests for saturated and unsaturated compounds**	**2**	2
	(i)Oxidation (ii) Bromination		
V	**Tests to distinguish between following compounds**	**6**	2
1	monocarboxylic acid and dicarboxylic acid		
2	primary,secondary and tertiary amines		
3	monoamide and diamide		
4	aldehyde and ketone		
5	reducing and non reducing sugars		
6	monohydric phenols and dihydric phenols		
VI	**Reactions of common functional groups using known organic compounds**.	**6**	6
VII	**Systematic qualitative analysis with a view to characterization of the following functional groups**	**30**	6

1	Halo compounds :chlorobenzene, benzyl chloride,		
2	Phenols: phenol, *o ,m ,p* -cresols, naphthols, resorcinol		
3	Aldehydes and ketones: benzaldehyde, acetophenone, benzophenone		
4	Carboxylic acids: benzoic, phthalic, cinnamic and salicylic acids		
5	Esters: ethyl benzoate, methyl salicylate		
6	Amides: benzamide, urea		
7	Anilines: aniline, *o,m, p* - toluidines, dimethylaniline		
8	Nitro compounds: nitrobenzene, *o*- & *p*- nitro toluene		
9	Poly nuclear hydrocarbons: naphthalene, anthracene		
10	Reducing and non reducing sugars: glucose and sucrose		
VIII	**Preparation of Organic Compounds.**	**16**	5&6
1	Halogenation :Bromination of acetanilide		
2	Nitration of Acetanilide or nitrobenzene		
3	Oxidation of benzaldehyde/Toluene/Benzyl chloride		
4	Acetylation of salicylic acid or aniline Benzoylation of phenol or aniline		
5	Hydrolysis of ethyl acetate and benzamide		
IX	***Preparation of Soap**		
X	**Chromatography**	**10**	4
1.	**TLC of simple organic compounds (using TLC sheets)		
2	*Paper chromatographic separation of mixture of inks and sugars		
3	*Column chromatographic separation of a mixture of dyes		
XI	***Organic estimations**	**4**	8
1	Estimation of phenol		
2	Estimation of Aniline		
XII	**Determination of physical constants	**3**	3
XIII	Steam distillation –Extraction of essential oil from citrus fruits/eucalyptus leaves (NOT FOR ESE)	**3**	4

** **Experiments under X or XII are compulsory but only one is expected for a batch.**

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SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards
SEMSTER VI Core Course-XIV

LAB COURSE V GRAVIMETRIC EXPERIMENTS

(ESE at VI Semester)

Semester	VI
Course	Core Course-XIV, Lab Course V
Course name	GRAVIMETRIC EXPERIMENTS
Course Code	CH1645
Credit	2
Hours	4 hours/week (72Hrs)
Lecture-Tutorial-Lab	0-0-4

CO No.	COURSE OUTCOME *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Understand precipitation techniques in quantitative context	U	PSO1
2	Appreciate the application of silica crucible and sintered crucible in gravimetry	A	PSO2 PSO8
3	Practice technique of making, diluting solutions on quantitative basis	A	PSO1
4	Realise the factors affecting precipitation/crystallisation	A	PSO1
5	Take precautionary measures in filtration , drying and incineration of precipitates	U	PSO3
6	Understand the principle of colorimetry to estimate Fe^{3+} and ammonia	A	PSO1& PSO2
7	Practice Punctuality and regularity in doing experiments and submitting Lab records	A	PSO18

MODULE	COURSE DESCRIPTION	Hrs	CO No.
I	**Precipitation and Filtration Techniques**	**10**	1,2
1	True solution , Colloids, Precipitates		
2	Saturated and super saturated solutions		
3	Solubility product and common ion effect		
4	Precipitating agents		

5	Co-precipitation and post precipitation		
6	Washing of precipitate based on principle of solvent extraction		
7	Filtration using Whatmann Filter paper		
8	Desiccating agents and use of desiccators and vacuum desiccators		
9	Incineration in silica crucible		
10	Use of sintered crucible and its advantages and limitations		
II	**Gravimetric Estimations**		
A	**Estimations using silica crucible**	**30**	1,2
1	Estimation of water of crystallization in hydrated Barium chloride		
2	Estimation of Barium as Barium sulphate		
3	Estimation of sulphate as Barium sulphate		
4	Estimation Iron as Fe_2O_3		
5	Estimation Calcium as $CaCO_3$		
6	Estimation Aluminium as Al_2O_3		
7	Estimation Magnesium as $Mg_2P_2O_7$		
B	**Estimations using sintered crucible**	**20**	1,2
1	Magnesium as oxinate		
2	Nickel as nickel dimethyl glyoximate		
3	Copper as copper thiocyanate		
4	Silver as silver chloride		
II	**Colorimetry**	**12**	3
1	Determination of Fe^{3+} using thiocyanate		
2	Determination of ammonia using Nessler's reagent.		

Textbooks

1. A.I.Vogel, "A text book of Qualitative Analysis including semi micro methods" Longmans.
2. V.V.Ramanujam, "Semi micro Qualitative Analysis"
3. E.S.Gilreath "Qualitative Analysis using semi micro method" Mc Graw Hill
4. A.I.Vogel, "A text book of Qualitative Inorganic Analysis" Longmans
5. A.I.Vogel, "Elementary Practical Organic Chemistry" Longmans
6. J B Yadav,Advanced Practical Physical Chemistry, Goel ,Publishing House

For Further Reading

1. Day and Raman, "Laboratory Manual of Organic Chemistry".
2. B.Viswanathan and P.S Raghavan , "Practical Physical Chemistry" 2005 Edn. Viva Books (Pvt.Ltd)
3. F.G Mann and B.C Saunders, "Practical Organic Chemistry" 4^{th} Edn, Orient Longmann
4. A.Findlay, "Practical Physical Chemistry" Creative Media
5. R.C.Das and E.Behara, "Experimental Physical Chemistry", Tata Mc Graw Hill
6. N.K.,Vishnu, "Advanced practical organic chemistry" Vikas publishing house, New Delhi

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

2020 Admission onwards

Semester	V-VI
Course	**PROJECT COURSE**
Course name	**PROJECT**
Course Code	**CH1646**
Credit	4
Marks	100 (No CE marks)
Lecture-Tutorial-Lab	0-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**	**PSO No.**
1	Develop an aptitude for research in chemistry	U,A	PSO1
2	Practice research methodology and literature search	A	
3	Critically choose appropriate research topic and presentation	A	PSO2 PSO8

GUIDELINES FOR PROJECT COURSE (Course Code CH1646)

- The board of examiners can decide the scheme of evaluation of project , study tour report and viva voce
- Topics of chemical interest can be selected for the project. Project is to be done by a group not exceeding 5 students on approval by the teacher in charge.
- Every student should submit typed (A4 paper, 12 Font, 1.5 Space, 20- 30 pages), spirally bind
  project report duly attested by the supervising teacher and the Head of the Department on the day of practical examination before a board of two Examiners for ESE.
- The viva-voce based on the project is conducted individually.
- Project topic once chosen shall not be repeated by any later batches of students.
- List of projects submitted year wise is to be maintained in a register and submitted before the examiners if necessary.

. .**The project report may contain the following sections**

1. Preliminary (Title page, declaration, certificate of the supervising teacher, content etc.)
2. Introduction with relevant literature review and objective
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion / Summary
7. References

STUDY TOUR AND FACTORY VISIT

Students are directed to

- Visit at least one chemical factory preferably with in the state of Kerala.
- Submit scientifically prepared hand written study tour report along with photographs of candidate at the places of visit for ESE on the day of the examination of project evaluation.

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2020 Admission onwards
OPEN COURSE FOR OTHER MAJORS

Semester	V
Course	Open Course
Course name	**CHEMISTRY AND ITS APPLICATIONS**
Course Code	CH 1551.1
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	COURSE OUTCOME *Upon completion of this course, students*	Cognitive level	PSO
1	Appreciate the history of evolution of science	U	PSO1
2	Develop curiosity and scientific attitude towards the application of chemistry in daily life	C	PSO1
3	Appraise the current development in Chemistry and contribution of chemistry for sustainable development	E	PSO1
4	Identify the common ingredients of house hold synthetic products	U	PSO 8
5	Classify chemicals according to their uses	U	PSO3
6	Critically choose cosmetics and cleansing agents for daily use	E	PSO15
7	Adopt safer and healthier life skills in harmony with nature	A	PSO21

MODULE	COURSE DESCRIPTION (No Chemical structure required)	Hrs	CO No.
1	**Evolution of Chemistry as a discipline of science**	**9**	1,2
1.1	Evolution of Chemistry - ancient speculations on the nature of matter, early form of chemistry-alchemy.	1	
1.2	Chemical revolution, Atomic and Molecular Theory	1	
1.3	Comparison of Rutherford's atom model with solar system	2	
1.4	Major contributions of Mendeleev, Michael Faraday and Marie Curie.	1	
1.5	Scope of Chemical Science, branches of Chemistry, Basic idea of interdisciplinary areas involving Chemistry	1	

2	**Chemistry for energy production**	**9**	3
2.1	Electrochemical cell-cathode and anode, Daniel cell, Dry cell	**2**	
2.2	Fuels: Definition and classification of fuels, characteristics of a good fuel, Combustion, calorific value, Wood, coal, Classification based on carbon content	2	
2.3	Petroleum, Origin, Petrol- Diesel, Flash point. Aviation fuels	2	
2.4	Natural gas, biogas, and LPG- composition Pollution due to burning of fossil fuels	2	
2.5	Solar energy and solar cells (applications only)	1	
3	**Vitamins , hormones, enzymes and nucleic acids**	**9**	2
3.1	Vitamins: Vitamin A, B_2, C, D, E and K source, function and deficiency diseases	3	
3.2	Hormones: Insulin and its function, Thyroid hormones, Iodine deficiency condition	2	
3.3	Enzymes: as Biological catalysts,– Role of enzymes in digestion of food	2	
3.4	Nucleic acids: RNA and DNA, Role of nucleic acids in life process (No structure or chemical reactions)	2	
4	**Chemistry in day today life**	**9**	3,7
4.1	**Food Chemistry**: Food additives, preservatives, anti oxidants, commonly used permitted and nonpermitted food colours -artificial sweeteners-taste enhancers Health effects of fast foods, instant foods, dehydrated foods and junk foods	2	
4.2	**Cosmetics**: talcum powder, lip sticks, nail polish, moisturiser Sun screen lotions and hair dye	2	
4.3	**Cleansing agents**: Soaps- Hard and soft soaps, alkali content-TFM, Detergents and Shampoos.	1	
4.5	**Plastics** : Thermo plastics and thermosetting plastics, Plastic identification codes, biodegradable plastics (PGA,PLA and PHBV) and their applications, Importance of Plastic recycling	2	
4.6	**Pharmaceuticals**: Drugs, classification into analgesics, antacids, antibiotics, antiseptics, disinfectants, anaesthetics, tranquilisers, narcotics and antidepressants-one example	2	
5	**Environmental Chemistry I**	**9**	**2,7**
5.1	Air pollution: Composition of air, major causes of air pollution, Pollutants in air-carbon monoxide, carbon dioxide, oxides of Nitrogen and sulphur , chlorofluro	2	

	carbons- effect of using refirigerators and air conditioners, Particulate matter- Acid rain, Green house effect, ozone layer and its depletion		
6	**Environmental Chemistry II**	**9**	2,7
6.1	Water pollution: causes- heat, industrial waste, sewage water, detergents, agricultural pollutants Treatment of industrial waste water- Activated charcoal, Reverse osmosis Quality of drinking water- Indian Standard and WHO standard- Dissolved oxygen- BOD , COD	6	
6.2	Soil pollution: pesticides, fertilizers, Industrial waste, Plastic.	3	

Reference

1.T F Giereyn, Cultural boundaries of science) University, Chikago Press, 1999
2 N C Dutta, The Story of Chemistry, University Press

3.MSR Winter, A Consumer's dictionary of cosmetic ingredients, 7th edition, Three Rivers Press, NewYork,2009
4.B K Sharma, Polymer chemistry, Goel Publishing House, Meerut, 1989
5. B K Sharma, Industrial chemistry, 11th edition, Goel Publishing House, Meerut, 2000
6.A K Day,"Environmental chemistry-An Introduction", New Age Publisher, 8th edition
7. B Srilakshmi, Food Science,5th edition, New Age Publishers, NewDelhi,2010
8. Organic Chemistry of Drug action and drug design-L B Silverman, Elsvier,
9. Medicinal Chemistry , An introduction, II nd edition Gareth Thomas, Wiley, India,2011

UNIVERSITY OF KERALA
Model Question Paper First Degree Programme
2020 Admission onwards
SEMESTER V Course Code CH1551.1
OPEN COURSE FOR OTHER MAJORS
CHEMISTRY AND ITS APPLICATION

SECTION A
Answer all questions in one word , each question carry one mark

1.Name any one interdisciplinary area of chemistry
2.Early form of chemistry is called--------
3.Enzymes are called biological ---------
4. Name the hormone produced byPancrease
5.Alkali content of soap is expressed as ------

6.PGA is a biodegradable plastic. State true or false
7 .Name the main constituent of LPG
8.White lead is a --------
9.Which among DNA and RNA determine heredity ?
10.Night blindness is caused by deficiency of
a)Vitamin A,b)Vitamin C,c)Vitamin.D,d)Vitamin K

SECTION B

Each Question carries 2 marks. Answer any 8 questions.

11.Give two examples each for enzymes and hormones.
12. How will you distinguish between hard and soft soaps?
13.What are nucleic acids? Give examples.
14.How does acid rain occurs?
15.Define calorific value of a fuel.
16.Suggest a natural way of harvesting solar energy. Explain.
17.How will you classify fuels?
18.Name two petroleum based fuels.
19.How do iodine deficiency affect human beings?
20.What is an electrochemical cell?
21.Name the electrodes in Daniel cell.
22. What is the cause of green house effect?

SECTION C

Each Question carries 4 marks. Answer any 6 questions.

23. Explain the source and hazards of fly ash and asbestos.
24. Explain briefly soil pollution.
25. Write a note on enzymes.
26. List four different types of drugs
27. Distinguish between antiseptics and disinfectants
28. What are the characteristic of a good fuel?
29. What are the functions and deficiency diseases of Vitamin C, Vitamin D ?.
30. Write a note on Enzymes.
31. Discuss on the health effects of fast food and junk food.

(4×6 = 24 marks)

SECTION D

Answer any two questions (15 marks each)

32. a) Discuss on the major contributions of Rutherford .
    b) Differentiate between cathode and anode. Identify the anode and cathode in Dry cell
    c) Chemistry is the central science of many other disciplines.Justify (5x3 = 15 marks)

33. a) Write a note on Dalton's atomic theory.
    b) How do Refrigerators cause air pollution? Explain.

c) Write a note on vitamin deficiency disease. (5x3 = 15 marks)

34. a) What are the 'Three R's of plastic control?

b) What is meant by DNA? Name the sugar unit present in DNA.

c) Write a note on Drugs. (5x3 = 15 marks)

35. a) Explain the cleansing action of soap.

b) What is antibiotic? Give the names of the first antibiotic and the scientist who discovered it.

c) Give an account of the green house effect. (5 x 3 =15 marks)

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UNIVERSITY OF KERALA

OPEN COURSE FOR OTHER MAJORS

SEMESTER-V CREDIT-2 COURSE CODE-CH1551.2

Semester	V
Course	Open Course
Course name	**FUNDAMENTALS OF CHEMISTRY AND ITS APPLICATION TO EVERYDAY LIFE**
Course Code	CH 1551.2
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Appreciate the evolution of Science and Chemistry and the early form of chemistry	U	PSO1
2	Understand the dvelopement of Chemistry as a discipline and the role of chemistry as a central science	U	PSO1
3	Discuss the fundamental properties of atom, structure of atom, classification of elements in to a periodic table	U	PSO3
4	Differentiate between simple molecules and giant molecules and the bonding nature	U	PSO11
5	Explain different types of bonding and predict stability	U	PSO4

6	Compare properties of graphite and diamond and their structural differences	U	PSO4
7	Identify house hold chemicals, their advantages and disadvantages	U	PSO12
8	Become aware of chemical hazards and the precautions in handling chemicals	A	PSO12
9	Beware of food adulterants	A	PSO12 PSO21
10	Critically select chemical fertilizers,artificial sweeteners, beverages, and food preservatives	A	PSO21

MODULE	**COURSE DESCRIPTION**	**Hrs**	**CO No.**
1	**Evolution of Chemistry**	**9**	**2**
1.1	Evolution of Chemistry - ancient speculations on the nature of matter, early form of chemistry -alchemy	3	
1.2	Robert Boyle and the origins of modern chemistry in the latter 1600s - origin of modern chemistry - Antoine Lavoisier and the revolution in chemistry	3	
1.3	Role of Chemistry as a central science connecting Physics, Biology and other branches of science. Basic ideas of interdisciplinary areas involving Chemistry	3	
2	**Atomic structure**	**9**	**2**
2.1	Atom- model of Dalton- Thomson – Rutherford and Bohr	3	
2.2	Nature of electron proton and neutron – atomic number – mass number- isotopes -state the relative charges and approximate relative masses of a proton, a neutron and an electron	3	
2.3	Description with the aid of diagrams, the structure of simple atoms as containing protons and neutrons (nucleons) in the nucleus and electrons arranged in shells (energy levels-K,L,M etc) (mention only of s, p, d and f orbitals)	3	
3	**Periodic table**	**9**	**2**
3.1	The Periodic Table - Periodic trends, Group properties - describe the relationship between group number and the ionic charge of an element-	3	
3.2	similarities among the elements in the same group - metallic to non-metallic character from left to right across a period of the Period Table	2	
3.3	Classification into s,p,d, and f block- General Properties of elements in Group I and XVIII using the Periodic	4	

	Table, metals, nonmetals, metalloids and inert gases		
4	**Structure and properties of materials**	**9**	**5**
4.1	Elements, compounds and mixtures – elementary idea of ionic bond and covalent bond	2	
4.2	Compare the structure of simple molecular substances, e.g. methane; water, carbon dioxide, iodine, with those of giant molecular substances, e.g. poly(ethene); sand (silicon dioxide);	4	
4.3	Diamond and graphite in order to deduce their properties compa the bonding structures of diamond – graphite, electrical conductivity	3	
5	**Chemicals used in everyday life.**	**9**	**8**
5.1	Household materials – Major chemical ingredients (No structural formula and preparation needed), : Match Box- Soap- detergent— cooking gas – tooth paste – shampoo- hair dye- nail polish- whitener-moth balls, house hold bleach	4	
5.2	method of action and possible hazards/toxicity of	3	
5.3	Explosive chemicals, propellants –fire crackers.	2	
6	**Chemicals in food and beverages**	**9**	**9**
6.1	Important chemical ingredients/ taste makers used in packed food - soft drinks - and its health hazards ,Chemicals in food production	3	
6.2	fertilizers used in natural sources - Fertilizers urea, NPK and Super phosphates - uses and hazards.	2	
6.3	Adulterants in milk, ghee, oil, coffee powder, tea, asafoetida, chilli powder, pulses and turmeric powder - identification	2	
6.4	artificial sweeteners - food preservatives	2	

UNIVERSITY OF KERALA

Model Question Paper First Degree Programme

2020 Admission onwards

SEMESTER V Course Code CH1551.2 Credit 2

OPEN COURSE FOR OTHER MAJORS

FUNDAMENTALS OF CHEMISTRY & ITS APPLICATION TO EVERYDAY LIFE

Time: Three Hours **Maximum Marks : 80**

SECTION A

(Answer in a word / sentence) Answer all questions

1. Name the early form of chemistry
2. Who is the father of modern chemistry?

3. What is superphosphate?
4. ^{1}H , ^{2}H and ^{3}H are called --------of hydrogen
5. Diamond is chemically ----(carbon, gold, Silicon, glass)
6. What is main constituent of LPG ?
7. Mercury is a liquid ----(metal, nonmetal, metalloid, none of the above)
8. Silica is the chemical name of (sand, soap,silver, carbon)
9. Artificial sweeteners and ------- ---- are common in junk food.
10. What is periodicity?

SECTION B

Each question carries 2 marks (Short answer type).
Answer any eight questions .

11. Name any two Toxic Chemicals in Cosmetics
12. Obtain the electron configuration for (a) N; (b) F.
13. Explain Hund's rule of maximum multiplicity with an example.
14. Define electron affinity, explain with an example.
15. Which of the following elements Li, Be, B, C, N, O, F and Ne are metals?
16. Explain Bohr model of atom.
17. Why is the electronegativity value of most noble gases equal to zero?
18. What are the Health Effects of Drinking Soda?
19. Which do you expect to have more metallic character, Lead (Pb) or Tin (Sn)
20. What is a Match Head of match stick made of?
21. Explain why graphite conducts electricity whereas diamond doesn't.
22. Is the reactivity of group I metals increasing or decreasing down the group? Explain why?

(2×8 = 1

SECTION C

Each question carries **4 marks** (Short essay type)
Answer any six **questions**

23. Explain the colour of firecrackers.
24. What is the difference between covalent and ionic bonding?
25. What are periods and groups in the periodic table? What is periodicity?
26. What are adulterants.
27. How is Thomson's model of the atom different from Dalton's model of atom?
28. What's the difference between an oxidation number and an ionic charge?
29. Explain the health hazards associated with drinking soft drinks?

30. How can metallic character change across a period?

31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

SECTION D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
    b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
    c. Describe the metallic character of elements in a period. (5x3 marks)

33. a.Explain the role of some chemicals in household items. (8 marks)
    b.Write a short note on food adultration. (7 marks)

34. a.Write a short note on the uses and hazards of fertilisers. (8 marks)
    b.Draw the structure of carbon and sodium (shell model) (7 marks)

35. a. Draw the structures showing shapes of methane, water and carbon dioxide (8 marks)
    b.compare the bonding structures of diamond – graphite. (7marks)

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OPEN COURSE FOR OTHER MAJORS

2020 Adimission onwards

Semester	V
Course	Open Course
Course name	**ENVIRONMENTAL CHEMISTRY**
Course Code	CH 1551.3
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Discuss the structure and composition of the atmosphere	U	PSO14
2	Identify,Realise and enlist the causes of pollution to water, soil and air	U	PSO14
3	Become aware of environmental issues and its effect to man and other living beings	U	PSO12
4	Review major environmental disasters and suggest controlling and preventive measures	U	PSO12
5	Discuss the laws of environmental protection	U	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Environmental Components** Structure and composition of the, Atmosphere, hydrosphere, biosphere and Lithosphere – composition of atmosphere	**9**	**1,2,3**
2	**Water pollution** Sources, its effect and control; Sampling and measurement of water quality and their analysis, water quality standards, BOD and COD Hard water – soft water Eutrophication and restoration of lakes.	**9**	**1,2,3**
3	**Air Pollution** Types and sources of air pollution, Common Air Pollutants - Effects of air pollution; Smog – ozone layer depletion green house effect – acid rain	**9**	**1,2,3**
4	**Soil Pollution** Sources, types, effects and control of: Land pollution, Marine pollution, Thermal Pollution and Radioactive pollution. Waste separation, storage and disposal ; Waste Reduction, Recycling and Recovery of materials.Plastics and their misuses.	**9**	**1,2,3**
5	**Major environmental disasters** Major environmental disasters - mercury poisoning in Minamata, Japan, Itaiitai disease due to cadmium poisoning in Japan - Love Canal toxic waste site, Seveso disaster chemical plant explosion - Bhopal disaster - Chernobyl incident	**9**	**4**
6	**Major environmental laws:** Environment (Protection Act) – The Air (Prevention and control of pollution) Act – The water (Prevention and control of pollution) Act – The wild life protection Act – Forest conservation Act – The Ozone Depleting Substances (Regulation and Control) Rules – The Plastic Waste (Management and Handling) Rules - Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (elementary ideas only)	**9**	**5**

Reference

1. Banerji, K Sameer“Environmental Chemistry”, ISBN - 9788120315761.
2. K. De “Environmental Chemistry - An introduction” New Age International (P)Ltd.,2017
3. B. K. Sharma “Air Pollution”, Goel Publishing House
4. V. K. Ahluwalia “Environmental Chemistry”, books.google.co.in, 2017
5. G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A Global Perspective”
6. S.K.Mohanty, Environment and Pollution Laws, Universal Law Publishing Co. (P)Ltd

UNIVERSITY OF KERALA
Model Question Paper for
B.Sc Chemistry Programme
OPEN COURSE FOR OTHER MAJORS
Semester V Course Code CH1551.3 Credit -2
ENVIRONMENTAL CHEMISTRY

Time: 3 hours
Marks: 80

SECTION A

Answer all questions (Each question carries 1 mark)

1. What you meant by Triple R in waste management ?.
2. What type of pollution causes acid rain?
3. What are the misuses of plastics?
4. What are the three major man made sources of air pollution?
5. What kind of materials are discharged into the seas?
6. What increases the amount of carbon dioxide in the atmosphere?
7. Explain the action of zeolites on hard water.
8. What are freons?
9. Define pollution
10. What is fly ash?

SECTION B

(short answer type) (Answer any 8 questions, Each answer carries 2 mark)

11. How is pollution related to acid rain?
12. How does ocean pollution affect sea animals?
13. What are the main concepts of Green Chemistry
14. Write short note on Radioactive pollution
15. Discuss the major composition of earth's atmosphere 16. Write about the cause and consequence of Chernobyl incident
17. What is BOD and COD?
18. What causes radioactive pollution?
19. Distinguish between Hard water and soft water.
20. What is the goal of Forest Conservation Act?
21. What is the Greenhouse effect and what is its cause? 22. What are the types of air pollutants ? **(2×8 = 16)**

SECTION C

(Short essay type) each question carries **4**marks. Answer **any**

23. Write short note on volatile organic compounds.
24. How can thermal pollution be prevented?
25. How do you control Radioactive pollution?
26. What is smog? How does smog arise?
27. What is Eutrophication
28. Write a note on Rio-Declaration.
29. Explain the various layers of the Atmosphere
30. What is Air Pollution? How can air pollution be minimized?
31. Briefly explain about the components of atmosphere.

SECTION D

Answer **any 2** from the following. Each question carries **15** marks

32. (a) Explain Hardness of water and the different types. (5 marks)
    (b) Discuss about the various sources of water pollution. (5 marks)
    (c) What are the control measures for water pollution ? . (5 marks)
33. (a) Write short note on causes and problems of ozone layer depletion?
    (b) Explain the various types of smog.
    (c) Discuss the Ozone Depleting Substances (Regulation and Control) Rules
34. (a) Explain thermal pollution
    (b) Discuss about plastics and their misuses
    (c) Discuss about Chernobyl disasters
35. (a) Discuss about green chemistry
    (b) Explain Montreal protocol and Kyoto protocol
    (c) The water (Prevention and control of pollution) Act (15 × **2= 30)**

UNIVERSITY OF KRALA

SYLLABUS FOR B.Sc. CHEMISTRY

FIRST DEGREE PROGRAMME

2020 Admission Onwards

ELECTIVE COURSES

Semester	V1
Course	Elective Course
Course name	**SUPRAMOLECULAR, NANO PARTICLES AND GREEN CHEMISTRY**
Course Code	**CH1651.1**
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Become aware of pollution caused by industries	U	PSO13
2	Recognise the necessity of green approaches to protect nature	R	PSO14
3	Discuss about sustainable development and logical use of natural resourses	U	PSO14
4	Motivated to more ecofriendly life style	A	PSO21
5	Realises the importance of microscsale approaches and nano material research	U	PSO13 PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Green Chemistry-I**	**9**	**1-5**
1.1	Role of Chemical Industries in polluting the environment	1	
1.2	Limitations of conventional waste management and pollution prevention-birth of green chemistry	2	
1.3	introduction to the principles of green chemistry-atom economy calculation(simple reactions)	2	
1.4	-production of Ibuprofen-less hazardous chemical syntheses, designing safer chemicals	2	
1.5	Bhopal gas tragedy- new greener syntheses, safer solvents and auxiliaries ionic liquids-super critical fluids CO_2 and H_2O, advantages of SCFs	2	
2	**Green Chemistry-II**	**9**	**1-5**
2.1	Design for energy efficiency-principle of microwave oven, microwave assisted organic syntheses, simple examples-	2	
2.2	renewable feedstock- biodiesel, preparation, advantages	2	
2.3	catalysis, green catalysts- inherently safer chemistry for accident prevention	2	
2.4	Green chemistry practices in research, educational and commercial laboratories- lab safety signs-introduction to micro scale experiments.	1	
3	**Chemistry of Nano Materials - I**	**9**	**2**
3.1	Classifications of nanostructured materials, nano particles; quantum dots, nanowires, ultra – thinfilms multilayered materials.	2	
3.2	Synthesis of nanometre scale particles of colloidal semiconductors such as TiO_2, CdS, ZnO, $BaTiO_3$, by wet chemical methods, hydrothermal methods, and pyrolytic or high temperature methods.	2	
3.3	Carbon nanotubes fullerenes and graphene.	2	
	Synthesis and purification of carbon nanotubes, Singlewalled carbon nanotubes and multiwalled carbon nanotubes, Structure-property relationships.	3	
4	**Chemistry of Nano materials - II**	**9**	**2**
4.1	Preparation of self-assembled monolayers, core shell nanoparticles and quantum dots.	2	
4.2	Properties of nanoparticles: optical, magnetic, mechanical, thermal and catalytic properties,	2	
4.3	characterisation of nano particles by AFM, STM and	2	

	SEM. Applications of nanomaterials:		

4.3	Characterisation of nano particles by AFM, STM and SEM. Applications of nanomaterials:	2	
4.4	Potential uses of nanomaterials in electronics, robotics, computers, sensors, mobile electronic devices, vehicles and transportation. Medical applications of nanomaterials	3	
5	**Molecular recognition**	**9**	**5**
5.1	The concepts of molecular recognition, host, guest and receptor systems.	**3**	
5.2	Forces involved in molecular recognition.	**3**	
5.3	Hydrogen bonding, ionic bonding, p-stacking, vander Waal's and hydrophobic interactions.	**3**	
6	**Supramolecularchemistry**	**9**	5
6.1	Introduction to molecular receptors-design principles	**2**	
6.2	Tweezers, Cryptands and Carcerands, Cyclophanes, Cyclodextrins and Calixarenes	**2**	
6.3	Typical examples Molecular recognition and catalysis-catalysis by cation receptors, anion receptors and cyclophanes	**3**	
6.4	Molecular recognition in DNA and protein structure	**2**	

References

1. Anastas. P.T.; Warner, J.C.,"Green Chemistry; Theory and Practice", Oxford University Press; Oxford , U.K.,1998.
2. Lancaster,M,"Green Chemistry; An Introductory Text",Royal Society of Chemistry; Cambridge,UK, 2003
3. Rashmi Sanghi and M.M Srivasthava, "Green Chemistry Environment Friendly Alternatives", Narosa Publishing House,2006
4. T.Pradeep, "NANO: The Essentials", 'McGraw-Hill Education'.
5. D. Nasipuri "Stereochemistry of Organic Compounds", Wiley
6. J M Lehn, "Supramolecular Chemistry", V C H.
7. H Vogtle, "Supramolecular Chemistry", W iley.
8. P S Kalsi, J P Kalsi,"Bioorganic, Bioinorganic and supramolecular Chemistry", New Age International

UNIVERSITY OF KERALA
Model Question Paper B.Sc Chemistry Programme
2020 Admission Onwards
SEMESTER VI Course Code CH1651.1 Credit 2
ELECTIVE COURSE
SUPRAMOLECULAR, NANO
PARTICLES AND GREEN CHEMISTRY

Time: 3 Hours **Maximum marks : 80**

SECTION A

Answer all questions. Each question carries 1 mark.

1. Define atom economy.
2. Write an example of green catalyst.
3. Between an addition and elimination reaction which is having a better atom economy?
4. Name a colloidal semiconductor.
5. Expand SAMS.
6. What is graphene?
7. Name the different allotropes of carbon.
8. Name any two molecular receptors.
9. What are cryptands?
10. Define π stacking.

SECTION B

Answer any eight questions. Each question carries 2 marks.

11. Write a note on Bhopal Tragedy.
12. Define Carbon efficiency.
13. Explain the limitations of conventional waste management.
14. Give any four lab safety signs with its meaning.
15. Write about the wet method of preparing colloidal semiconductors.
16. What are the magnetic properties of nanoparticles.
17. Briefly describe the catalytic properties of nano materials.
18. Explain the different types of SWCNTs.
19. What are the non-covalent bonds involved in molecular recognition?
20. Define host and guest in supramolecular chemistry.
21. Write a note on Cyclodextrins.
22. What are molecular tweezers?

SECTION C

Answer any six questions. Each question carries 4 marks.

23. What are secondary electrons?
24. Write a note on safer solvents and auxiliaries.
25. Explain ionic liquids.
26. Write a note on biodiesel.
27. Describe the synthesis of quantum dots and mention its optical properties.
28. Explain the preperation of SAMs.
29 Discuss the potential applications of nanomaterials in computers, sensors, and Medical

applications.
30. Discuss the various aspects of molecular recognition involved in the structure of DNA.
31 Write notes on cation and anion receptors.

SECTION D

Answer any two questions. Each question carries 15 marks.

32. (a)Explain the twelve principles of green chemistry. (10marks)
    (b) Explain microwave assisted organic syntheses with an example. (5marks)
33. (a) Explain the principle and working of SEM
    (b) Write a note on synthesis and purification of carbon nanotubes.
34. Write short notes on (a) calixarenes (b) Cyclodextrins (c) cyclophanes.
35. Write short notes on(a) molecular recognition(b) preparation biodiesel(c)non bonded interactions.

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME

SEMESTER V1 **COURSE CODE CH1651.2**
ELECTIVE COURSE
COMPUTATIONAL, COMBINATORIAL AND PHYSICAL ORGANIC CHEMISTRY

Semester	V1
Course	Elective Course
Course name	**COMPUTATIONAL, COMBINATORIAL AND PHYSICAL ORGANIC CHEMISTRY**
Course Code	**CH1651.2**
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	Cognitive Level	PSO No.
1	Understand the use of Chemistry related softwares	U	PSO5
2	Discuss computational methods and combinatorial synthesis	U	PSO5
3	Classify reaction mechanism with suitable examples	U	PSO10
4	Understand the role of Thermodynamic functions in the study of Kinetics	U	PSO11
5	Correlate structure with reactivity	A	PSO11

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Introduction to Computational Chemistry**	**9**	**1**
1.1	Web resources in chemistry learning,	1	
1.2	Introduction to structure drawing, spread sheet and chemistry related softwares.	2	
1.3	Approximate methods in Quantum mechanics- Many electron atoms: Self consistent field method. Chemical bonding:	3	
1.4	Perturbation theory and variational principle. MO theory of hydrogen molecule ion. VB theory of hydrogen. Concept of resonance.	3	
2	**Computational Methods**	**9**	**1,2**
2.1	Brief description of computational methods: ab initio, semi empirical, DFT and molecular mechanics.	2	
2.2	RHF, ROHF &UHF methods Basis sets, STO &GTO	2	
2.3	Z-matrix of simple molecules H2O, CO2 & NH3	3	
2.4	Common computational and visualization softwares	2	
3	**Combinatorial Chemistry Introduction**	**9**	**2**
3.1	Early development, what is combinatorial synthesis, library synthesis on resin beads,	3	
3.2	solid phase chemistry, Merrifield peptide synthesis, support for solid phase synthesis,	3	
3.3	parallel synthesis and mix and split library synthesis.	3	
4	**Combinatorial Synthesis**	**9**	**2**
4.1	Libraries on multipins, libraries on wicks, libraries on		

	laminar solid phases (no detail study).		
4.2	Solution phase library synthesis- eg.-, Hantzsch synthesis of aminothiazole, peptide and nonpeptide libraries(eg. only),.		
4.3	Applications of combinatorial chemistry in drug discovery		
5	**Introduction to Physical organic chemistry**	**9**	**3-5**
5.1	Classification of mechanism with suitable examples. Bond breaking mode – Heterolytic, Homolytic and Pericyclic Nature of reaction –	2	
5.2	Substitution, Elimination, Addition, Pericyclic and Rearrangement reactions. Nature of reagent – Nucleophilic, Electrophilic and Free radical.	2	
5.3	Thermodynamic and Kinetic control of reaction. The Hammond postulate (qualitative treatment). The thermodynamic functions – ΔH, ΔS and ΔG and their determination from Arrhenius equation. Role of above thermodynamic functions in mechanistic probe of reactions.	3	
5.4	Methods of determining mechanism, Identification of products, Detection of intermediates, Catalytic study, Isotopic labeling, Stereochemical evidence, Kinetic evidence	2	
6	**Correlation of structure with reactivity**	**9**	**3-5**
6.1	The effect of substrate structure – Differences in mechanism for primary, secondary and tertiary systems.	2	
6.2	The effect of a and ß substitution – the +I and –I effects (Inductive effects of electron releasing and electron withdrawing groups at a and ß positions).	1	
6.3	Substitution of mono and bicyclic (at a and ß positions) aromatic rings (Resonance effects). Hyperconjugate effects.	2	
6.4	Neighbouring group effect nonclassical bridge head	2	
6.5	Steric effects – B-strain, Strain in aliphatic cyclic systems. Steric inhibition of resonance – ortho effect and a-effect, The Hammett equations	2	

References :

1. Guy H. Grant and W.Graham Richards, "Computational Chemistry", OCP(29) 2. Christopher J. Cramer, John Wiley,"Essentials of Computational Chemistry",
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4. Ira N. Levine," Quantum Chemistry".
5. David Young, "Computational Chemistry A Practical Guide for Applying

Techniques to Real World Problems”, Wiley Interscience.

6. N K Turret, “Combinatorial Chemistry”, (Oxford Publication)
7. Jerry March "Advanced Organic chemistry”, 3rd edition, Wiely International (Indian edn New Delhi) Chapter 6 and 10
8. P S Kalsi,“ Text of organic Chemistry”, Mac million India ltd 1999 Ch 2
9. M K Jain and S C Sharma,“ Modern Organic Chemistry” , Vishal Publishing Co, 2004, Chapter 3,4, 15

UNIVERSITY OF KERALA
Model Question Paper of BSc Chemistry Programme
2020 Admission onwards
SEMESTER VI - Course Code CH1651 .2 Credit 2
ELECTIVE COURSE

COMPUTATIONAL, COMBINATORIAL AND PHYSICAL ORGANIC CHEMISTRY

Time: 3 Hours **Marks : 80**

SECTION A

Answer all questions.
Each question carries 1 mark.

1. Write Arrhenius expression and explain the terms.
2. What is RHF?
3. What are nucleophilic reagents? Give examples.
4. Name any two structure drawing softwares.
5. Write Hammett equation.
6. Give one example solution phase library synthesis.
7. Write any two examples for polyamide resin.
8. Propene is more stable than ethane. Why?
9. What is combinatorial synthesis?
10. Write any two examples for heterolytic bond breaking reaction.

1 X 10 = 10 Mark

SECTION B

Answer any eight questions from the following. Each question carries 2 marks.

11. What are the web resources in learning Chemistry?
12. What is a basis set ?
13. What are the major mechanisms of organic reactions ?
14. Distinguish between STO & GTO.
15. Explain the advantages of combinatorial synthesis.

16. What is meant by electrocyclic reaction. Give one example.
17. What are the applications of combinatorial synthesis.
18. What are multipins used in combinatorial synthesis
19. Explain kinetic requirements of reaction.
20. Explain Hammond postulate.
21. Explain +I and – I effects.
22. Explain isotopic labeling in the study of organic reactions. **2× 8 = 16**

SECTION C

Answer any six questions from the following. Each question carries 4 marks.

23. Draw the Z matrix of H2O & NH3
24. Why SEM is called parametrisation method
25. How can a eight – member dipeptide library is synthesized ?
26. Explain non-peptide libraries.
27. How are the intermediates detected?
28. Explain substitution reactions of naphthalene.
29. Explain the effect of leaving group in aliphatic substitution reactions.
30. What is self consistent field method.
31. Explain mix and split library synthesis. **6 X 4 = 24 Marks**

SECTION D

Answer any two questions from the following. Each question carries

32. (a)Explain MO theory of hydrogen molecule ion.
(b)Explain VB theory of hydrogen .
10 + 5 = 15 Marks
33. (a)Explain neighboring group participation with examples.
(b)Explain sterric effects and B-strain. 7.5 + 7.5 = 15 Marks
34. (a) How does the structure of substrate affect the aliphatic nucleophilic substitution?
(b) Comment on the effect of substituent on nucleophilic substitution reaction.
7.5 + 7.5 = 15 Marks
35. (a) Write a brief description of methods(a) ab initio(b)DFT (c) molecular mechanics.

5+ 5+ 5 = 15 Marks

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards

Semester	V1
Course	Elective Course
Course name	**POLYMER CHEMISTRY**
Course Code	**CH1651.3**
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	COURSE OUTCOME *Upon completion of this course, students*	Cognitive Level	PSO No.
1	Differentiate between Natural and synthetic polymers	U	PSO14
2	Understand polymerization process of monomeric units	U	PSO12
3	Critically analyse the advantages and disadvantages of polymers	A	PSO12
4	Analyse different Applications of Polymers	A	PSO4
5	Identify the properties of polymers.	U	PSO11
6	Realize the necessity of biodegradable substitutes for a sustainable development	U,A	PSO12 PSO12

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Introduction to polymers**	**9**	**1**
1.1	Brief history of macromolecular science, general characteristics of polymers in comparison with common organic compounds.	2	
1.2	Nomenclatures. Distinction between plastics, elastomers and fibres. Natural polymers- cellulose, silk, gums and resin.	2	
1.3	Types of polymers- thermoplastics and thermosettings, functionality concept. Concept of cross linked polymers.	2	
1.4	Types of polymerization- addition, condensation, ionic, co-ordination. Addition – polymerisation – mechanism,	3	

	initiation , propagation and termination processes, initiators, inhibitors. Mechanism of ionic polymerization		
2	**Methods of polymerization**	**9**	**2**
2.1	Methods of polymerization-bulk, suspension, emulsion, solution necessity of copolymers and copolymerization, blocks and graft copolymers.	2	
2.2	Thermosetting polymers-examples, synthesis, chemistry, properties and applications of phenol- formaldehyde resins	2	
2.3	synthesis, chemistry, properties and applications of amino resins, urea-formaldehyde and melamine-formaldehyde resins	2	
2.4	synthesis, chemistry, properties and applications of polyurethanes epoxy resins- grades of epoxy resins, curing process and its importance with mechanism , poly carbonates, silicones	3	
3	**Elastomers-I**	**9**	**5**
3.1	thermoplastic polymers, Polyisoprene, polybutadiene, neoprene.	2	
3.2	synthesis, chemistry, properties and applications of Polyolefins, polyethylenes_HDPE, LDP,LLDP,	4	
3.3	synthesis, chemistry, properties and applications of polyvinyl chloride-grades of PVC, Teflon, Polystyrene-homopolymers, copolymers such as SBR, ABS, SAN.	3	
4	**Elastomers 2** .	**9**	**2**
4.1	Vinyl polymers- polyvinyl acetate and its modifications like PVA, PVB and polyacetals	3	
4.2	Polyamides - nylon -6, nylon-66 and other nylons.	2	
4.3	Poly ethers and poly esters, terephthalates. Cellulosics such as esters, ethers, acetates, butyrates, nitrate, CMC; regenerated cellulose	4	
5	**Experimental methods-1**	**9**	**2**
5.1	Molecular weight and molecular weight distribution – number , weight and viscosity average molecular weights of polymers	2	
5.2	methods of determining molecular weight, practical significance of molecular weight distribution, size of polymers.	2	
5.3	Introductory concepts of kinetics of polymerization and Carother's relation.	3	
5.4	Glassy state, glass transition temperature, TGA, factors affecting GTT, crystallinity in polymers.	2	

6	**Experimental Methods –II**	**9**	**2**
6.1	Viscosity, solubility, optical properties, electrical properties, thermal properties, mechanical properties of polymers	2	
6.2	Degradation of polymers by thermal, oxidative ,mechanical and chemical methods.	2	
6.3	Polymer processing- compression moulding, casting, extrusion , fibre spinning, injection moulding, thermoforming, vulcanization of elastomers	2	
6.4	Polymer industry in India.	1	
6.5	**Overall advantages and disadvantages of using synthetic polymers**	**1**	**3,6**
6.6	Necessity of biodegradable substitutes for a sustainable development	1	

References

1. Bllmeyer, "Textbook of polymer science", John Wiley and Sons
2. D.D. Deshpande, "Physical chemistry of macromolecules", Vishal publications, New Delhi, 1985
3. V.R. Gowariker, N.V. Viswanathan and J.Sreethan, "Polymer Science", Wiley Eastern Ltd, 1986
4. K.J. Saunders, Organic Polymer Chemistry, 2nd Edn., Chapman and Hall, London, 1988
5. Gowri Sankar Misra, Introductory Polymer Chemistry, New Age International, New Delhi
6. P Ghosh, Polymer Science & Technology, Tata McGraw Hill Eduction, 1991
7. Jeol R.Fried, Polymer Science & Technology, Prentice Hall of India (P) Ltd. New Delhi, 1999.

UNIVERSITY OF KERALA

Model Question Paper of BSc Chemistry Programme

2020 Admission onwards

Course Code CH1651.3

SEMESTER VI ELECTIVE COURSE

POLYMER CHEMISTRY

Time: Three Hours **Maximum Marks: 80**

SECTION A

Each question carries 1 mark (Answer in one word\sentence)
Answer all questions
1. What are elastomers?
2. How is melamine-formaldehyde resin prepared?
3. Write a note on Nylon 66.
4. Mention the monomer unit of neoprene.
5. Define copolymers.
6. Explain extrusion.
7. Define fibre spinning.
8. Explain emulsion polymerisation
9. Give two examples of natural polymers 10. What is SBR and SAN?

SECTION B

Answer any eight questions. Each question carries 2 marks.
11. Write a note on Condensation polymerisation.
12. Explain the synthesis of HDPE.
13. Write a note on Polyurethanes.
14. Explain number, weight and viscosity average molecular weight.
15. Define graft copolymers.
16. Explain the preparation of PVC.
17. What are epoxy resins?
18. Explain the vulcanisation of ealstomers.
19. Write the mechanism of ionic polymerisation.
20. Explain the chemical methods of degradation of polymers.
21. Explain polymer processing.
22. Distinguish between thermoplastics and thermosetting plastics.

SECTION C

Answer any six questions. Each question carries 4 marks

23. Write a short note on silicones.
24. What are the methods of determining molar mass?
25. Write notes on (1) compression (2) moulding (3) casting
26. Discuss the synthesis and application of Teflon
27. Describe the role of initiators and inhibitors in addition polymerisation
28. Distinguish between plastics, elastomers and fibres
29. Describe the TGA of polymers.
30. Discuss the various aspects of molecular recognition involved in the structure of DNA.
31. Explain kinetics of polymerization and Carothers relation

SECTION D

Answer any two questions. Each question carries 15 marks.

32. Discuss the methods of
(a) Determining molecular weight (9+6)
(b)Practical significance of molecular weight distribution

33. Write a note on (6+9)
(a) vinyl polymers
(b) discuss about the methods of synthesis of PVA, PVB and Polyacetals.

34. (a) Explain crystallinity in polymers (6+9)
(b) Explain thermal, electrical and mechanical properties of polymers.

35. Write notes on (5+5+5)
(a) compression (b) moulding (c) casting

UNIVERSITY OF KERALA

Model Question Paper for BSc Chemistry Programme

2020 Admission onwards

Semester	V1
Course	Elective Course
Course name	**BIO CHEMISTRY**
Course Code	**CH1651.4**
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Recognise the constituents of blood and blood coagulation factors	R,U	PSO21
2	Become aware of the role of organs, in maintaining health	U	PSO21
3	Realise applications of Analytical techniques and instruments for biochemical studies	U	PSO9

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MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Blood** Constituents of blood cells and plasma, plasma proteins, albumin and globular - lipoproteins, functions (Details not expected), Coagulation - 'Coagulation factors, Hemoglobin - functions, Structure of hemoglobin, abnormal hemoglobin	**9**	**1**
2	**Respiration** Chemical and physiological events, affecting diffusion of O2 and CO2 during respiration, Transport of Oxygen in Blood O2 dissociation curve, Interrelationship between O2 and CO2 transport.	**9**	**2**
3	**Kidney Function** Body water balance, buffers in blood, Formation of Urine, Kidney function, Renal Threshold, Constituents of Urine, diseases associated with Kidney function	**9**	**2**
4	**Nutrition** Measurement of Energy Value of food , Calorific value, caloric requirement, Kilocalorie. Basal metabolic rate (BMR):- Significance, Condition, factors , measurement	**9**	**3**
5	**Digestion and Absorption of Food** Outline study of digestion and absorption of Carbohydrates, proteins, fats and enzymes involved , comp osition and functions of bile - Bile pigments, Bile acids, Bile salts.	**9**	**2**
6	**BiochemicalTechniques** Chromatography - Ion exchange, adsorption paper, TLC, GLC, affinity, Gel filtration Electrophoresis - paper, gel, ultracentrifugation	**9**	**3**

References

1.Gyton,"Text Book of Medical Physiology".

2. Ganog,"Text Book of Medical Physiology ".
3. David Randall, "Physiology".
4. Dr. A.C. Deb, "Fundamentals of Biochemistry".
5. Swaminathan, "Advanced Text Book on Food & Nutrition".
6. B. Srilakshmi, "Nutrition Science".

UNIVERSITY OF KERALA
B.Sc Chemistry Programme Model Question Paper

2020 Admission onwards

Semester VI Course Code CH1651 .4 Credit 2
ELECTIVE COURSE
BIOCHEMISTRY

Time: 3 hours **Maximum marks: 80**

SECTION A

Answer all questions (maximum two sentences each question carries 1 mark)

1. What is the normal pH of arterial blood?
2. What is the cause of sickle cell anemia?
3. Give an example for plasma protein.
4. What are anticoagulants?
5. Define BMR?
6. What is the renal threshold value of glucose?
7. What is NPN?
8. What is the calorific value of fat?
9. Name the bile pigments.
10. What is GLC?

(10x1=10 marks)

SECTION B

Answer any eight, each question carries 2 marks

11. Define renal threshold and its significance?
12. What are the normal constituents of urine?
13. What are the different types of hemoglobin?
14. Write a short note on protein digesting enzymes.
15. Draw the structure of heme
16. What are the constituents of blood?
17. What are the functions of plasma protein?
18. What is difference between plasma and serum?
19. What is adsorption chromatograpy?
20. What is the composition of bile?
21. Write about abnormal hemoglobin.
22. Discuss about ion exchange chromatography.

SECTION C

Answer any six each question each question carries 4 marks

23. Explain Oxygen dissociation curve and factors affecting its shift.
24. Describe gel electrophoresis.
25. Explain thin layer chromatography.
26. Explain briefly the buffers in blood.
27. Give an account of diseases affecting kidney function.
28. Discuss about ultracentrifugation.
29. Discuss the physiological events involved in the transport of oxygen and carbon dioxide.
30. Describe briefly about the various blood cells.
31. Briefly explain about lipoproteins and their functions.

(6 x 4 = 24 marks)

SECTION D

Answer any two (essay) Each question carries 15 marks

32.Discuss about
(i) Coagulation factors (ii) Anticoagulants (iii) Mechanism of blood clotting.

33. Discuss about the principle procedure and applications of
(i) SDS PAGE (ii) Affinity chromatography (iii) Gel filtration chromatography

34. Describe
(i) Body water balance (ii) Functions of kidney (iii) Formation of urine.

35. Discuss about the digestion and absorption of
(i) Carbohydrate (ii) Protein (iii) Fat

(15 x 2 =30 marks)

UNIVERSITY OF KERALA

First Degree Programme in Chemistry

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

CHEMISTRY COMPLEMENTARY COURSES

SCHEME AND SYLLABI

2017 ADMISSION ONWARDS

General Instructions to Complementary courses

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

B Sc Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Semester	Hours per week		Number Of Credits	Course code*	Instructional Hours
	Theory	Lab			
1	2	2	2	CH1131 .1	2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .1	2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .1	3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .1 CH1432 .1	3×18 =54 2×18 = 36

- Course code of physics majors is used as an example

GENERAL ASPECTS OF EVALUATION

CONTINUOUS EVALUATION FOR LECTURE COURSES

The Continuous evaluation will have 20 marks and will be done continuously during the semester. CE components are

(i) Attendance for lecture and laboratory sessions (to be noted separately where both lecture and laboratory hours have been specified within a course);

(ii) Assignment /seminar and

(iii) Test

. The weightage is shown in Table I.1. There will be two class tests for which, the better of the two grades obtained will form part of CE. Seminar for each course to be organized by the course teacher and assessed along with a group of teachers in the Department. The topic selection by the student for assignments/seminar will be with the approval of the course teacher.

No	Component	Marks
1	Attendance	5
2	Assignment / Seminar	5
3	Tests	10
	Total	20

QUESTION PAPER PATTERN FOR CONTINIOUS EVALUATION TEST

1. The theory examination has a duration of 1.5 hours
2. Each question paper has three parts: A, B , C
3. Part A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence.
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer 7 questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Part C contains nine questions of which the candidate has to answer 4 questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type). Question paper should contain 20% hard, 60% medium and 20% easy questions

QuestionPaperPatternforTest		
QuestionNo	*Typeof Question*	*Marks*
Part A: 1-10	All / one word/one sentence	1X10=10
Part B: 11-22	7out of 12; Short Answer	7 X2=14
Part C: 23-31	4 out of 9; Short Essay	4 X4= 16
TOTAL		40 marks

CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation will have 20 marks. The ESE of laboratory courses will be done only in the IV semester. But the corresponding CE are calculated from all the semesters in which there is attendance for laboratory sessions?

No	Component	Marks
1	Attendance	5
2	Lab test	5
3	Record	5
4	Punctuality	5
	Total	20

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I. 2. 1. EVALUATION OF THE RECORD

On completion of each experiment, a report should be presented to the course teacher as soon as the experiment is over. It should be recorded in a bound note -book and not on sheets of paper. The experimental description should include aim, principle, materials/apparatus required/used, method/procedures, and tables of data collected, equations, calculations, graphs, and other diagrams etc. as necessary and final results. Careless experimentation and tendency to cause accidents due to ignoring safety precautions will be considered as demerits.

CE for Laboratory Record		
No	Sub Component	Marks

1	Punctual submission and Neat presentation	All four sub-components present & satisfactory 5 Only three : 4 Only two : 3 Only one : 2
2	Record of more than 90% experiments in the syllabus	
3	Calculations and absence of errors/mistakes	
4	Accuracy of the result	

During ESE external examiner has to verify the Lab report of experiments certified by the tutor and HOD. The scheme of examination for lab exams may be framed by the Board of examiners.

END SEMESTER QUESTION PAPER PATTERN & GUIDELINE FOR QUESTION PAPER SETTERS

1. The theory examination has a duration of 3 hours
2. Each question paper has four parts: A, B, C and D
3. Part A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence.
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer eight questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Part C contains nine questions of which the candidate has to answer six questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).
6. Part D contains four questions of which the candidate has to answer two. Each question carries 15marks.Essay type question. Each question carries two or three subdivisions (10+5) or (5+5+5) pattern.
7. The total weightage for the entire questions to be answered is 80 marks.
8. Question paper should contain 20% hard,60% medium and 20% easy questions.
9. Question paper setter shall submit a detailed scheme of evaluation along with question paper.

QuestionPaperPatternforTest		
QuestionNo	*TypeofQuestion*	*Marks*
Part A: 1-10	10 one word/one sentence	1x10=10
Part B: 11-22	8 out of 12; Short Answer	2x8=16
Part C: 23-31	6 out of 9; Short Essay	4x6=24
Part D: 32-35	2 out of 4; Essay	2x15=30
		Total = 80-80 marks

SYLLABUS OF COMPLEMENTARY COURSE
(For students of Physics Majors)

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course*	Title of Course	Instructional Hours
1	2	2	2	CH1131 .1		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .1		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .1		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .1 CH1432 .1		3×18 =54 2×18 = 36

I B.Sc Complementary
THEORETICAL CHEMISTRY
(For students of Physics majors)
(Common for Physics and Geology students)

SEMESTER I Complementary Course N o. – 1 Course Code- CH1131 .1 Credit-2
Total Hour : 36 L–T-P- 2-0-2

Module I –Atomic Structure 9hrs

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module II - Chemical bonding 9hrs.

Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.

Polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.

Hybridisation and structure of molecules – SP, SP^{2}, SP^{3}, dSP^{2}, dSP^{3}, $SP^{3}d^{2}$, and $SP^{3}d^{3}$ hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O2,$O2^{2+}$,$O2^{2-}$,NO,NO+,CO and HF.

Module–III:Radioactivity
9hrs.

Radio active equilibrium (qualitative idea only) detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry – Units – rad, gray and roentgen. Fricke dosimeter and ceric sulphate dosimeter. Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module IV: Analytical principles9 Hrs

Analytical methods in Chemistry – principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis, common ion effect- solubility product- precipitation of cations-chromatography- principle and applications of paper and thin layer chromatography.

References

1. Atomic structure and chemical bonding withintroduction to molecular spectroscopy- Manas Chandra.
2. Inorganic chemistry- Puri, Sharma and Kalia
3. Fundamental concepts of inorganic chemistry- E S Gilreath
4. Inorganic chemistry-Madan
5. Basic inorganic chemistry-F A Cotton, G Wilkinson and P L Guas
6. Elements of nuclear chemistry- Arnicker
7. Text book of qualitative analysis- A I Vogel
8. Text book of quantitative inorganic analysis- A I Vogel

9. Quantitative analysis: Laboratory manual- Day and Underwood

First semester B.Sc Degree Examination Model question paper

Complimentary course for PhysicsCH1131.1: THEORETICALCHEMISTRY

(2017 admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?
6. Emission of ------ from a radioactive element does not bring any change in charge or mass.
7. What is the base of radiocarbon dating.
8. What is the result of the beta emission of group 15 element?
9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.
10. Calculate the normality of 10% NaOH solution.

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. State Hund's rule.
12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?
13. Write the Schrodinger wave equation and explain the terms?
14. NH_3 and CH_4 have SP^3 hybridization. Shapes of these molecules are different. Why?
15. Distinguish between intermolecular and intramolecular hydrogen bonding?
16. The bond energy of NO^+ is larger than that of NO. Why?
17. Define Soddy's group displacement law?
18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?

19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?
20. Phenolphthalein is not suitable for the titration of strong acid X weak base. Why?
21. How would you prepare 100ml of 0.05M Mohr's slat solution?
22. What are primary standards? Give two examples. SECTION C

(Answer any six questions. Each question carries 4 mark)

23. Why is Bohr model of atom considered inadequate?
24. Explain hydrogen spectrum?
25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?
26. Explain the shape of SF_6 molecule.
27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.
28. Explain neutron activation analysis and its application?
29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.
30. Explain the principle and application of paper chromatography?
31. Explain the theory of redox indicators.

SECTION D

(Answer any two questions. Each question carries 15 mark)

32. (i) What are quantum numbers? Give the significance of each? (5 marks)

    (ii) Write the postulates of Bohr model of atom? (5 marks)

    (iii)Define Aufbau principle with example and explain the stability of half-filled and fully filled orbital? (5 marks)
33. (i) write a short note on Born- Haber cycle?

(ii) Draw and explain the MO diagram for O_2 molecule.

(iii) Describe the different approaches of electronegativity?

34. (i) Derive an equation for the decay constant of a radioactive material.

    (ii) If at the end of 67.5 years only 3.125% of a radioactive material remains without decay.

    What is the half life of the decay?

    (iii) Give an example each for proton, neutron and deuteron induced reactions.
35. (i) what are acid base indicators?

    (ii) explain the use of indicators in acid base titrations.

    (iii) Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

SYLLABUS OF COMPLEMENTARY COURSE

(For students of Physics majors)

(Common for Physics and Geology students)

Physical chemistry-I

SEMESTER II Complementary Course No.- 2 Course Code-CH1231 .1Credit – 2

Total Hours - 36 L-T-P 2-0-2

ModuleI –Thermodynamics 9hrs

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of $C_P - C_V = R$. Second law of thermodynamics, entropy and free energies, significance of Δ G, Δ H and available work – criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

Module II Thermochemistry:9hrs

Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

Module III –Chemical Equilibrium 9 hrs

Reversible reactions – K_P, K_C, and K_X and their inter relationships – Free energy change and chemical equilibrium (thermodynamic derivation) – van't Hoff reaction isotherm and isochore - influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ Le Chatelier's principle and the discussion of the above reactions on its basis.

Module IV–Ionic Equilibrium9hrs

Concepts of Acids and Bases, ionization of weak electrolytes. Influence of solvent on acid strength – leveling effect - pH and its determination of potentiometric method. Buffer solutions and calculations of their pH. Henderson equation. Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base.

References

1. Principles of physical chemistry-Puri, Sharma and Pathania
2. Advanced physical chemistry-Gurudeep Raj
3. Thermodynamics for chemists- S Glastone
4. Elements of physical chemistry- Glastone and Lewis
5. A text book of physical chemistry-K L K Kapoor
6. Physical chemistry-P C Rakhit

Second semester B.Sc Degree Examination Model question paper

Complimentary course for Physics Majors

Semester II Complementary Course No.- 2 Course Code-CH1231 .1Credit – 2

PHYSICAL CHEMISTRY- I

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. What is a reversible process?
2. Write the first law of thermodynamics.
3. What is an isochoric process?
4. What is standard enthalpy of formation?
5. Write one example for an exothermic reaction.
6. What is enthalpy of hydration?
7. What is rate constant?
8. What is the significance of ΔG?
9. What is common ion effect?
10. What is the P^H of 0.01M HCl?

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?
12. State the first law of thermodynamics. What are its limitations?
13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?

14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) ___ C_2H_6 (g).Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.
15. Define Enthalpy of formation.
16. What is bond dissociation energy?
17. State Le Chatlier principle.
18. What is isochoric process?
19. What are the characteristics of equilibrium constant?
20. Define Lewis acid and base.
21. What is meant by levelling effect?
22. What is ionic product of water?

SECTION C

(Answer any six questions. Each question carries 4 mark)

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?
26. State and explain Hesse's law.
27. Derive relation between heat of reaction at constant volume and constant pressure.
28. Calculate the equilibrium constant for a reaction at 25^0C. ΔG^0=20kcal.
29. Predict the effect of pressure on the dissociation of PCl_5.
30. What is meant by Buffer solution? Give an example of acidic and basic buffer solution? Explain its mechanism?
31. Write Henderson equation. What is its significance? SECTION D

(Answer any two questions. Each question carries 15 mark)

32. (i) Derive an expression for work done in the reversible isothermal isothermal expansion of an ideal gas. (ii) Define
    (a) Work function
    (b) Gibbs free energy function
    (c) Entropy
    (d) Internal energy
33. (i) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.

(ii) Calculate the heat of formation of CO_2. Given that CO (g)+H_2O (l) $\rightleftharpoons$ CO_2 (g)+ H_2(g); ΔH=0.7 kcal. Heat of formation of H_2O (l) and CO (g) are -68.3 and -26.4 $kcalmol^{-1}$ respectively.

34. (i) Derive van't Hoff equation.

(ii) Derive relation between Kp and Kc.

(iii)The equilibrium constant of a reaction doubles on raising the temperature from 25^0C to 35^0C. Calculate ΔH^0 of the reaction?

35. (i) Define pH of a solution. Calculate the pH of 0.2M acetic acid in 0.5M sodium acetate at 298K. Dissociation constant of acetic acid at 298K is 1.8 $x10^{-5}$?

(ii) Write a note on salt hydrolysis?

SYLLABUS OF COMPLEMENTARY COUSRSE (For students of Physics Majors)
PHYSICAL CHEMISTRY- II
SEMESTER III Course-3 Credit-3Course Code – CH1331.1
L-T-P 3-0-2 54 Hrs

Module 1: Gaseous State 9hrs

Maxwell's distribution of molecular velocities (No derivation) average, most probable and rms velocities, collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of vander waals constants and critical constants – Law of corresponding states – reduced equation of state, Joule Thomson effect, liquefaction of gases – Linde's and claude's processes

Module II – Crystalline State 9hrs

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc of cubic crystals – Representation of lattice planes of simple cubic crystal - Density from cubic lattice dimension – calculation of Avogadro number - Bragg equation, diffraction of Xrays by crystals – single crystal and powder method. Detailed study of structures of NaCl and KCl crystals.

Module III - Electro Chemistry 9hrs

Transport number – definition, determination by Hittorfs method and moving boundary method, application of conductance measurements. Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base.

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, Fuel cells – H_2 – O_2 and hydrocarbon – O_2 type.

Module IV – Catalysis and Photo Chemistry 9hrs

General Characteristics of catalytic reactions. Different types of catalysis – examples – theories of catalysis (Outline of intermediate compound formation theory and adsorption theory). Enzyme catalysis – Michaelis-Menten mechanism.

Photo Chemistry:- Laws of Photo Chemistry, Grothus – Drapter law, Beer Lambert's law, Einstein's laws, quantum yield, H_2 – Cl_2 reaction, H_2 – Br_2 reaction – Fluorescence and phosphorescence, chemiluminescence and photo sensitization.

Module – V: Chemical Kinetics 9 Hrs

Rates of reaction, various factors influencing rates of reactions – order and molecularity – Zero, first, second and third order reaction, derivation of integrated rate equation, fractional life time, units of rate constants, influence of temperature on reaction rates. Arrhenius equation, calculation of Arrhenius parameters – collision theory of reaction rates.

Module VI-Group theory 9 Hrs

Group theory- elements of symmetry- proper and improper axis of symmetry- plane of symmetry-center of symmetry- identity elements, combination of symmetry elements-point group- C_{2v}, C_{3v} and D_{3h}- group multiplication table of C_{2v}- determination of point group of simple molecules like water, NH_3, BF_3

References

1. Principles of physical chemistry-Puri, Sharma and Pathania
2. Advanced physical chemistry-Gurudeep Raj
3. Physical chemistry- PW Atkins
4. Physical chemistry-F Daniel and R A Alberty
5. Physical chemistry-E A Moelwyn
6. Introduction to solids- L V Azaroff
7. Solid state chemistry- N B Hannay
8. Group theory in chemistry-V Ramakrishnan and M S Gopinathan
9. Group theory and its applications in chemistry- A
   Salahuddin kunju and G krishnan

Third Semester B.Sc Degree Examination Model Question Paper

Complimentary course for Physics

CH1331 .1: PHYSICAL CHEMISTRY- II

(2017 Admission onwards)

Time: Three Hours   Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1.What is the ratio of observed molar volume to ideal molar volume is?

2. Define Boyle temperature?

3. How many unit cell are possible in cubic crystal?

4. Why amorphous solids are said to be isotropic?

5. In a Galvanic cell electron flows from ……… to ………

6. What is the potential of SHE.

7. What is the quantum yield of H_2-Cl_2 reaction?

8. Define chemiluminescence

9. What is the order of the reaction with rate constant $2x10^{-2}$ $molL^{-1}s^{-1}$

10. NH_3 belongs to which point group?

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. Define critical temperature and explain its significance?

12. What is virial equation of states?

13. Explain the term Space lattice and Unit cell.

14. Both NaCl and KCl have fcc structures but KCl behaves towards X-rays like simple cubic lattice. Why?

15. What is liquid junction potential? How can it be eliminated?

16. What are reference electrodes? Give their significance?

17. State Einstein’s law of photochemical equivalence?

18. What is meant by chemiluminescence?

19. What is meant by autocatalysis?

20. Define order and molecularity of a reaction?

21. A substance decomposes following first order kinetics. The half life period of a reaction is 35 minutes. What is the rate constant of the reaction?

22. What is meant by point group?

SECTION C

(Answer any six questions. Each question carries 4 mark)

23. What is the law of corresponding states? How is it derived from the vander waal's equation?

24. Calculate the constants a and b, if Tc=31^{0}C, Pc=72.8atm and R=0.082lit atm/K?

25. What are the Miller indices? How are they determined?

26. EMF of a standard Daniel Cell is 1.01832 V at 298K. Temperature coefficient of the cell is 5x10^{-5}V/K. Calculate ΔG, ΔH, and ΔS of the cell reaction?

27. Write a brief note on Calomel electrode?

28. State and explain Beer-Lambert's law? What are its limitations?

29. Explain pseudo order reactions with suitable examples?

30. Give the group multiplication table for C_{2V}

31. Explain the different symmetry elements?

SECTION D

(Answer any two questions. Each question carries 15 mark)

32. (i) Explain Linde's and Claude's method of liquefaction of gases?

    (ii)Do all gases obey gas laws? Discuss some experimental results to explain the deviation and point out the causes which account for this behavior?

    (iii) explain the terms: collision frequency and collision diameter.

33. (i) Derive Bragg's equation for the diffraction of of X-rays by crystal lattice? How is this equation used in elucidating the crystal structure?

    (ii) In fcc lattice of NaCl the distance between Na^+ and Cl^- ions is 281 pm and the density of NaCl is 2.165g/cm^3. Compute Avogadro's no. from the given data. The molar mass of NaCl is 58.5g/mol.

    (iii) Assign the point groups of the molecule BF_3 and H_2O

34. (i) Write a brief note on fuel cells? (ii) State and explain Nernst equation (iii) Explain the principle of potentiometric titrations?

35. (i) What is catalysis? What are the general characteristics of catalyst? (ii) Derive an expression for rate constant of a first order reaction? (iii) Explain the influence of temperature on reaction rates?

SYLLABUS OF COMPLEMENTARY COUSRSE
(For students of Physics Majors)
Spectroscopy and Material Chemistry
SEMESTER IV Course-4 Credit-3 Course Code – CH1431 .1
L-T-P 3-0-2 Total 54hrs

Module I - Spectroscopy-I 9hrs

Regions of electromagnetic spectrum – different units to represent energy such as erg, joule, calorie, cm^{-1}, Hz and eV, their interconversions – interaction of radiation with matter, different types of energy levels of molecules – rotation, vibration and electronic levels. Rotation spectroscopy Microwave spectrum of diatomic molecules – expressions for rotational energy, selection rule – frequency separation and determination of bond length – vibrational spectrum – harmonic oscillator, equation for frequency of vibration, expression for vibrational energy,
selection rule, frequency separation, calculations of force constant, Electronic spectroscopy –types of transition and regions where they absorb.

Module II- SPECTROSCOPY- II 9 hrs

Raman spectroscopy – stokes and anti stokes lines, quantum theory of Raman spectrum – advantages and disadvantages of Raman spectrum, rotational Raman spectrum, selection rules and frequency separation. Vibrational Raman spectrum – Complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnet, energy spacing, transition between nuclear energy levels in hydrogen nucleus, low resolutionspectrum, chemical shift, spin – spin
coupling – fine structure spectrum, application to simple molecule

Module III Coordination Chemistry 9 Hrs

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis. 9 hrs

Module IV – Metallurgy 9 Hrs

General principles of occurrence and extraction of metals – purification, roasting, calcination and smelting, reduction to metal, different method with examples, refining of metals- electrolytic and zone refining. Van – Arkel method. Metallurgy of titanium, cobalt, nickel, thorium and uranium.

Module V :Chemistry of Nano Materials 9hrs

Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc.

Nanosystems in nature.

Preparation of Nano particles – Top – down approach and bottom – top approach, sol – gel synthesis, colloidal precipitations, Co- precipitation, combustion technique. Properties of nano particles: optical, magnetic and mechanical properties.

Tools for measuring nano structure – XRD, Atomic force Microscopy (AFM), Scanning Tunneling Microscopy (STM), and Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM). Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, Medical applications (use Au, Ag,ZnO and ZnO_2 as examples)

Module VI- Advanced Materials 9hrs

Magnetic materials-classification-applications- conducting polymers- polyacetylene-ployanilines- synthesis- applications- photoconducting polymers-examples-super conducting materials - Liquid crystals – mesomorphic state, types of liquid crystals applications and examples. .

References

1. Fundamental of molecular spectroscopy- C N Banwell
2. Atomic structure and chemical bonding in molecular spectroscopy- Manas Chandra
3. Physical chemistry-R Stephen Berry, Sturt A Rice and John Rose
4. Inorganic chemistry-J E HuheeCoordination chemistry- Bosolo and Johnson
5. Coordination chemistry- S F A Kettle
6. Inorganic chemistry- Puri, Sharma and Kalia
7. NANO: the essentials –T Pradeep
8. Introduction to Solid State Physics- Charles Kittel

Fourth semester B.Sc Degree Examination Model question paper

Complimentary course for Physics

CH1431 .1: Spectroscopy and Material Chemistry

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Which of the following give pure rotational spectrum: H_2, N_2, CO_2, HCl?
2. What is Rayleigh scattering?
3. What is the selection rule for vibrational transition?
4. What is the condition for a molecule to be NMR active?
5. What is Wilkinson's catalyst?
6. What is nano shells?
7. Write an example for a chelate.
8. What are the ores of titanium?
9. Name the nano meterials used in semiconductors?
10. What are ferromagnetic materials?

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. What is Born Oppenheimer approximation?
12. The force constant of HF molecule is 970Nm-1. Calculate the fundamental vibrational frequency as well as the zero-point energy?
13. What is Raman Effect? What is the cause of Raman effect?
14. Explain the terms shielding and deshielding with regard to NMR spectroscopy.
15. What is chemical shift?
16. Explain the effect of solvent in UV spectroscopy.
17. What is the difference between a double salt and a complex compound?
18. $[Fe(CN)_6]^{3-}$ paramagnetic. Why?
19. Explain Van Arkel method of refining of metals.
20. What is froth flotation?
21. What is STM and its basic principle?
22. Explain the synthesis of polyaniline from aniline. SECTION C

(Answer any Six questions. Each question carries 4 mark)

23.Why are anti-stokes lines intense than the stokes lines in the Raman spectrum?

24. Taking the example of HCl show how rotation of the molecule causes dipole moment fluctuations?
25. State and illustrate the Frank-Condon principle.

26. Define the terms: Bathochromic shift, Hypsochromic shift, hyperchromic shift, hypochromic shift.
27. Discuss Werner's theory of coordination compounds.
28. Explain the formation of low spin and high spin complexes with the help of crystal field theory.
29. Outline the principles involving electrolytic refining.
30. Explain the properties of nano particles.
31. Give a short note on superconducting materials. SECTION D

(Answer any twot questions. Each question carries 15 mark)

32. (i) Derive an expression for allowed energies of rotational levels ina diatomic molecule.

    (ii) Show that for a rigid diatomic rotor the moment of inertia is given by $I= \mu r^2$.

    (iii) Discuss the quantum theory of Raman spectroscopy 33.(i) Explain the underlying principle in an NMR spectrum.

    (ii)What are the different kinds of protons indicated in an NMR spectrum. How do they produce their characteristics signals?

    (iii)How can the NMR method be used to distinguish between the structures of 1propanol and 2-propanol?
34. (i) Give an account of crystal field theory?

    (ii) What are applications of coordination compounds in qualitative analysis? (iii) Give an account of hydrometallurgy.
35. (i) Explain the applications of nanomaterials in electronic and robotics.

    (ii) Explain working principle of SEM and TEM.

    (iii)Give a note on types of liquid crystals.

SYLLABUS FOR LABORATORY COURSES FOR B.Sc COMPLEMENTARY CHEMISTRYCourse V Course CodeCH1432 .1 Credit 2 For Physics & Geology MajorsSemesters 1, 2, 3 & 4

Reactions and identification of cations : Hg^+, Pb^{2+}, Ag^+, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} and NH_4^+

The cations must be provided in solutions. A student must analyse at least ten mixtures containing two cations each.

Volumetric analysis- one burette method only

A. Acidimetry and Alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. (Estimation of a strong base and a weak base using standardized HCl)
Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

[d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.]

(e. Estimation of a strong acid using standardized NaOH))

B. Permanganometry

a. Standardisation of KMnO4 by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate.

c. Estimation of Mohr's Salt. d. Estimation of calcium.

C. Dichrometry

e. Preparation of Std. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

f. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

g. Standardization of sodium thiosulphate using std. potassium dichromate. h. Estimation of copper in a solution

i. Estimation of iodine

E. Complexometric titrations

j. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

k. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Physical Chemistry Experiments

1. Conductometric titrations- HCl Vs NaOH
2. Potentiometric titrations- Ferrous iron Vs Dichromate

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1st ,2nd , 3rd and 4th semesters

Complementary Chemistry offered to Geology Majors

SYLLABUS OF COMPLEMENTARY COURSE
(For students of Geology Majors)
(Common for Physics and Geology students)I B.Sc Complementary
THEORETICAL CHEMISTRY
SEMESTER I Complementary Course – 1 Course Code- CH1131 .2 Credit-2

Total Hour : 36 L–T-P- 2-0-2

Module I –Atomic Structure 9hrs

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module II - Chemical bonding 9hrs.

Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.

Polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.

Hybridisation and structure of molecules – SP, SP^{2}, SP^{3}, dSP^{2}, dSP^{3}, $SP^{3}d^{2}$, and $SP^{3}d^{3}$ hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O2,$O2^{2+}$,$O2^{2-}$,NO,NO+,CO and HF.

Module–III:Radioactivity
9hrs.

Radio active equilibrium (qualitative idea only) detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry – Units – rad, gray and roentgen. Fricke dosimeter and ceric sulphate dosimeter. Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module IV: Analytical principles9 Hrs

Analytical methods in Chemistry – principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis, common ion effect- solubility product- precipitation of cations- chromatography- principle and applications of paper and thin layer chromatography.

References

1. Atomic structure and chemical bonding withintroduction to molecular spectroscopy- Manas Chandra.
2. Inorganic chemistry- Puri, Sharma and Kalia
3. Fundamental concepts of inorganic chemistry- E S Gilreath
4. Inorganic chemistry-Madan
5. Basic inorganic chemistry-F A Cotton, G Wilkinson and P L Guas
6. Elements of nuclear chemistry- Arnicker
7. Text book of qualitative analysis- A I Vogel
8. Text book of quantitative inorganic analysis- A I Vogel
9. Quantitative analysis: Laboratory manual- Day and Underwood

First semester B.Sc Degree Examination Model question paper

Complimentary course for Geology CH1131.2: THEORETICALCHEMISTRY

(2017 admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?
6. Emission of ------ from a radioactive element does not bring any change in charge or mass.
7. What is the base of radiocarbon dating.
8. What is the result of the beta emission of group 15 element?
9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.

10. Calculate the normality of 10% NaOH solution.

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. State Hund's rule.
12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?
13. Write the Schrodinger wave equation and explain the terms?
14. NH_3 and CH_4 have SP^3 hybridization. Shapes of these molecules are different. Why?
15. Distinguish between intermolecular and intramolecular hydrogen bonding?
16. The bond energy of NO^+ is larger than that of NO. Why?
17. Define Soddy's group displacement law?
18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?
19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?
20. Phenolphthalein is not suitable for the titration of strong acid X weak base. Why?
21. How would you prepare 100ml of 0.05M Mohr's slat solution?
22. What are primary standards? Give two examples.

SECTION C

(Answer any six questions. Each question carries 4 mark)

23. Why is Bohr model of atom considered inadequate?
24. Explain hydrogen spectrum?
25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?
26. Explain the shape of SF_6 molecule.
27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.
28. Explain neutron activation analysis and its application?
29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.
30. Explain the principle and application of paper chromatography?
31. Explain the theory of redox indicators.

SECTION D

(Answer any two questions. Each question carries 15 mark)

32. (i) What are quantum numbers? Give the significance of each? (5 marks)

    (ii) Write the postulates of Bohr model of atom? (5 marks) (iii)Define Aufbau principle with example and explain the stability of half-filled and fully filled orbital? (5 marks)

33. (i) write a short note on Born- Haber cycle?

(ii) Draw and explain the MO diagram for O_2 molecule.

(iii) Describe the different approaches of electronegativity?

34.(i) Derive an equation for the decay constant of a radioactive material.

(ii) If at the end of 67.5 years only 3.125% of a radioactive material remains without decay.

What is the half life of the decay?

(iii) Give an example each for proton, neutron and deuteron induced reactions.

35.(i) what are acid base indicators?

(ii) explain the use of indicators in acid base titrations.

(iii)Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

SYLLABUS OF COMPLEMENTARY COURSE

(For students of Geology majors)

(Common for Physics and Geology students)

Physical chemistry-I

SEMESTER II Complementary Course No.- 2 Course Code-CH1231 .2Credit – 2

Total Hours - 36 L-T-P 2-0-2

ModuleI –Thermodynamics 9hrs

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies,significance of Δ G, Δ H and available work – criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

Module II Thermochemistry 9hrs

Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff’s equation, Hess’s law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

Module III –Chemical Equilibrium 9 hrs

Reversible reactions – KP, KC, and KX and their inter relationships – Free energy change and chemical equilibrium (thermodynamic derivation) – van't Hoff reaction isotherm and isochore - influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ Le Chatelier's principle and the discussion of the above reactions on its basis.

ModuleIV–Ionic Equilibrium 9hrs

Concepts of Acids and Bases, ionization of weak electrolytes. Influence of solvent on acid strength – leveling effect - pH and its determination of potentiometric method. Buffer solutions and calculations of their pH. Henderson equation. Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base.

References

1. Principles of physical chemistry-Puri,Sharma and Pathania
2. Advanced physical chemistry-Gurudeep Raj
3. Thermodynamics for chemists- S Glastone
4. Elements of physical chemistry- Glastoneand Lewis
5. A text book of physical chemistry-K L K Kapoor
6. Physical chemistry-P C Rakhit

B.Sc Degree Examination Model question paper

Complimentary course for Geology Majors

Semester II CH1231.2: PHYSICAL CHEMISTRY- I

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. What is a reversible process?
2. Write the first law of thermodynamics.
3. What is an isochoric process?
4. What is standard enthalpy of formation?
5. Write one example for an exothermic reaction.
6. What is enthalpy of hydration?
7. What is rate constant?

8. What is the significance of ΔG?
9. What is common ion effect?
10. What is the P^H of 0.01M HCl?

SECTION B

(Answer any eight questions. Each question carries 2 mark)

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?
12. State the first law of thermodynamics. What are its limitations?
13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?
14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) C_2H_6 (g).Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.
15. Define Enthalpy of formation.
16. What is bond dissociation energy?
17. State Le Chatlier principle.
18. What is isochoric process?
19. What are the characteristics of equilibrium constant?
20. Define Lewis acid and base.
21. What is meant by levelling effect?
22. What is ionic product of water?

SECTION C

(Answer any six questions. Each question carries 4 mark)

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?
26. State and explain Hesse's law.
27. Derive relation between heat of reaction at constant volume and constant pressure.
28. Calculate the equilibrium constant for a reaction at 25^0C. ΔG^0=20kcal.
29. Predict the effect of pressure on the dissociation of PCl $_5$.

30. What is meant by Buffer solution? Give an example of acidic and basic buffer solution? Explain its mechanism?
31. Write Henderson equation. What is its significance? SECTION D

(Answer any two questions. Each question carries 15 mark)

32. (i) Derive an expression for work done in the reversible isothermal expansion of an ideal gas.

    (ii) Define

    (a) Work function

    (b) Gibbs free energy function

    (c) Entropy

    (d) Internal energy

33. (i) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.

    (ii) Calculate the heat of formation of CO_2. Given that CO (g)+H_2O (l) $\Leftrightarrow$ CO_2 (g)+ H_2(g); ΔH=0.7 kcal. Heat of formation of H_2O (l) and CO (g) are -68.3 and -26.4 kcalmol^{-1} respectively.

34. (i) Derive van't Hoff equation.

    (ii) Derive relation between Kp and Kc.

    (iii)The equilibrium constant of a reaction doubles on raising the temperature from 25 ^{0}C to 35^{0}C. Calculate ΔH^0 of the reaction?

35. (i) Define pH of a solution. Calculate the pH of 0.2M acetic acid in 0.5M sodium acetate at 298K. Dissociation constant of acetic acid at 298K is 1.8 x10^{-5}?

    (ii) Write a note on salt hydrolysis?

Complementary Chemistry

(For Geology Majors)

Physical , Analytical and Inorganic ChemistrySemester III Course-3 Credit-3Course Code – CH1331 .2

L-T-P 3-0-2 Total 54 hrs

Module I – Gascous State

Maxwell's distribution of molecular velocities (no derivation), average, most probable and RMS velocities collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of Vander Waal's constants and critical constants, law of corresponding states – reduced equation of state, Joule Thomson coefficient, liquefaction of gases –Linde's and Claudes process. 9 Hrs

Module II – Crystalline State

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems – Miller indices, Bravais lattices, primitive, bcc and fcc lattices of cubic crystals – Bragg equation - diffraction of X rays by crystals – single crystal and powder method. Detailed study of structure of NaCl and KCl crystals. Liquid crystals – mesomorphic state, types of liquidcrystals, application and examples. 9 hrs

Module III – Chemical Cycles and Group Properties

Carbon, Sulphur, Nitrogen, phosphorous and hydrologic cycle.

Group properties (reactions) of anions in common minerals – Carbonate, Sulphate, Phosphate, Sulphides and fluorides.

Classification of oxides – Acidic, Basic, Amphoteric and neutral 9 hrs

Module IV: Surface Chemistry and Colloids (9 Hrs)

Adsorption – types of adsorption of gases by solids, factors influencing adsorption,Freundlich adsorption isotherm – Langmuir adsorption isotherm (derivation not required).

Colloids:True solution, colloidal solution and suspension. Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples. Purification of colloids by electrodialysis and ultrafiltration. Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis. Origin of charge and stability of colloids – Coagulation - Hardy Schulze rule – Protective colloids - Gold number. Emulsions. Applications of colloids: Application of colloids Cottrell precipitator – purification of water, coagulation, reverse osmosis, electro dialysis, delta formation, medicines, cleaning action of detergents and soaps.

Module V Inorganic Polymers9hrs

General properties of inorganic polymer, phosphazenes – preparation of linear and cyclo phosphazene with examples, properties, and application, silicones – General methods of preparation and properties examples. Application of Silicones, Silicone rubber, silicone resins. 9 hrs

Module VI Soil and Water Chemistry 9 hrs

Soil – Composition, mineral matter in soil process of soil formation, weathering – physical (mention), chemical (detail) + biological (mention)

Saline and alkaline soil (brief explanation) Rocks – different types (Igneous, sedimentary and Meta morphic.) Analysis of lime stone qualitative treatment only.

Water Analysis Water quality parameters COD, BOD, main quality characteristics of water (alkalinity, hardness, total solids and oxidation)

Water treatment including chemical (Precipitation, aeration, osonisation,chlorination) and physical methods of sterilization.

References

1) Physical Chemistry-Rakshit

2) Principles of Physical Chemistry- Puri,Sharma, Pathania

3) Instrumental methods of Chemical Amalysis- B.K.Sharma

4) Vogel's Text book of Quantitative Chemical Analysis –VI Edition

5) Atomic structure with introduction to Molecular Spectroscopy – Manas Chanda

6) Physical Chemistry- N.M.Kapoor

7) Soil and Noise pollution- B.K.Sharma

8. Industrial Chemistry – B.K.Sharma.

Model Question Paper Chemistry (complementary) for Geology majors (2017 admission onwards)

Semester III Course Code: CH1331 .2 Course – III

Physical, Analytical and Inorganic Chemistry

Time: Three Hours Maximum marks: 80

Section A. Answer all questions. Mark 1.

1. Write the general formula of silica.
2. How oxides are classified?
3. Explain the term mean free path.
4. Name two classification of colloids based on solvent?
5. Explain Bravais lattices
6. Write the expression for RMS velocity.
7. What is inorganic rubber?
8. Define Brownian movement.
9. Define glass transition temperature.
10. Mention any two chemical methods of water sterilization.

Section B. Answer any eight questions. Each question carries 2 marks.

11. Distinguish between most probable velocity and average velocity.
12. State law of corresponding states.
13. Differentiate between isotropy and anisotropy.
14. Find the Miller indices of a crystal plane with intercepts 2a,2b and 3c.
15. Explain COD and BOD.
16. How will you analyse limestone qualitatively?
17. What is CMC
18. Draw Langmuir adsorption isotherm
19. What is the difference between colloid and suspension?
20. Define Boyle temperature.
21. What is Bragg's equation?
22. What is Joule- Thomson coefficient?

Section C. Answer any six questions. Each question carries 4 marks.

23. What are the causes for the deviation of real gases from ideality? How is it solved?
24. Explain symmetry elements in crystals.
25. Give an account of weathering with emphasis to chemical weathering.
26. What are inorganic polymers? How do they differ from organic polymers?
27. Give any one method for the preparation of silicones. What are the important applications of silicones?
28. Explain Hardy Schulze rule with the help of an example.
29. Give an account of carbon cycle.
30. Explain Linde's process of liquefaction of gases.

Section D. Answer any two questions. Each question carries 15 marks.

31. (a) Explain liquid crystals with examples for each type (b) Give a detailed account on the structure of NaCl.

32. Write a note on (a) Nitrogen cycle (b) different types of rocks and (c) main quality characteristics of water.
33. Give an account of the preparation, properties and important applications of (a) silicates (b) phosphazenes.
34. (a) Write a note on different types of adsorption of gases by solids.
    (b) Describe the applications of colloids.
35. (a) Write a short note on the various purification methods of water.
    (b) Calculate the average velocity and root mean square velocityof a molecule in a sample of oxygen at 0 °C?

Semester IV – Geology Majors

Physical and Analytical Chemistry -II Course-4

Credit -3Course Code – CH1431 .2

L-T-P 3-0-2 Total 54 Hrs

Module I Metallurgy

Metallurgy of Titanium, Iron, cobalt, Nickel, Thorium, Uranium. Extraction of lanthanides. 9 Hrs

Module II Petro Chemicals

Introduction to crude oil, exploratory methods, constitution of crude oil, natural gas - constituents. Distillation of crude oil, separation of natural gas and different fractions. Meaning of terms such as ignition point, flash point, octane number. Types of hydrocarbon fuels and their characteristics. Cracking – catalytic cracking, hydro cracking, isomerisation, reforming, sulphur, hydrogen, petroleum, coke and nitrogen compounds from petroleum. 9Hrs

Module III Chemical Kinetics

Rates of reactions, various factors influencing rates of reactions – order and molecularity - Zero, first, second and third order reactions – derivation of integrated rate equation, fractional life time – units of rate constants, influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenices parameters – Collision theory of rates. 9 hrs

Module IV Catalysis and Photo Chemistry 9hrs

Theories of catalysis, outline of intermediate compound formation theory and adsorption theory.

Photo Chemistry: Laws of photo Chemistry .Grotthus Draper Law, Einstein's law, Beer lambert law, Photo Chemical equivalence and quantum yield, explanation for high and low quantum yields, H2-Cl2 reaction, H2-Br2 reaction, Photosensitisation and Chemiluminescence.

Module V - Electro Chemistry 9hrs

Transport number – definition, determination by Hittorfs method and moving boundary method, application of conductance measurements. Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base.

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, Fuel cells – H2 – O2 and hydrocarbon – O2 type.

ModuleVI Instrumental Methods of Analysis9 hrs

Spectral methods – Atomic Absorption Spectroscopy (AAS) principle, measurement, advantages, disadvantages, and applications. Flame Emission Spectroscopy (FES) principle, measurement,(single beam method) applications.

Thermal methods: Thermo gravimetric analysis (TG) principle and method, Factors affecting thermogravimetric analysis, Application, Differential Thermal Analysis (DTA) principle, method, factors affecting DTA Applications.

References

1. Physical Chemistry-Rakshit
2. Principles of Physical Chemistry- Puri,Sharma, Pathania
3. Instrumental methods of Chemical Amalysis- B.K.Sharma
4. Vogel's Text book of Quantitative Chemical Analysis –VI Edition
5. Atomic structure with introduction to Molecular Spectroscopy – Manas Chanda

6. Physical Chemistry- N.M.Kapoor

7. Soil and Noise pollution- B.K.Sharma

8.IndustrialChemistry–B.K.Sharma.

Model Question Paper Chemistry (complementary) for Geology majors (2017 admission onwards)

Semester IV Course Code: CH1431.2 Course IV

Physical and Analytical Chemistry II

Time: Three Hours Maximum marks: 80

Section A. Answer all questions. Mark 1.

1. Write Arrhenius equation.
2. State Beer Lambert law.
3. Explain catalytic cracking.
4. Give an example of a negative catalyst with the chemical reaction which it catalyses.
5. The rate law for a reaction is r = k [A] $[B]^2$. Write the order of the reaction.
6. Define octane numbe r.
7. Name two important ores of Uranium.
8. Draw the shape of graph for the titration of a strong acid Vs strong base.
9. What you meant by flash point?
10. Conductance of an electrolyte depends on ………. and ………..

Section B. Answer any eight questions. Each question carries 2 marks.

11. What is the influence of temperature on reaction rate?
12. A substance decomposes following first order kinetics. The half life period of the reaction is 35 minutes. What is its rate constant?
13. State Einstein's law of photochemical equivalence.
14. Define quantum yield of a photochemical reaction.
15. Explain van't Hoff reaction isotherm.
16. Illustrate SHE.
17. Write the principle of AAS.
18. How do you differentiate a TG curve from a DTA curve?
19. What is smelting.
20. Distinguish between order and molecularity?
21. What is Grotthus- Draper law?
22. Explain chemiluminescence.

Section C. Answer any six questions. Each question carries 4 marks.

23. Give the Arrhenius equation. How will you determine the Arrhenius parameters?
24. Explain photosensitization reaction with an example.
25. Explain the method used to determine transport number of an electrolite.
26. What is the principle of flame emission spectroscopy? Mention its important applications.
27. What are the general methods for refining of metals?

28. Give an account of different types of hydrocarbon fuels and their characteristics.
29. Distinguish between isotherm and isochore.
30. Explain quantum yield in terms of H_2-Cl_2 reaction.

Section D. Answer any two questions. Each question carries 15 marks.

31. (a) Derive the expression for the rate constant of a first order reaction. (b) How will you express the units of rate constant for reactions of order 1, 2 and 3?
32. Write a note on (a) Extraction of lanthanides (b) Types of hydrocarbon fuels and their characteristics (c) Photosensitisation.
33. Give a detailed account on the principle and applications of (a) TG and (b) DTA.
34. (a) Discuss the principle, measurement and applications of Flame Emission Spectroscopy (FES)
    (b) Explain Collision theory of rates.
35. (a)Explain the method used to determine transport number of an electrolyte.
    (b) A solution of silver nitrate containing 12.14 g of silver in 50 ml of solution was electrolysed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, while 1.25 g of metallic silver was deposited on the cathode. Calculate the transport number of Ag+ and – NO3 ions.

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course CodeCH1432 .2 Credit 2 For Physics & Geology Majors

Semesters 1, 2, 3 & 4

Reactions and identification of cations : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} and NH_4^{+}

The cations must be provided in solutions. A student must analyse at least ten mixtures containing two cations each.

Volumetric analysis

A. Acidimetry and Alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl)

Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.

e. Estimation of a strong acid using standardized NaOH.

B. Permanganometry

a. Standardisation of $KMnO_4$ by oxalic acid sodium oxalate and Mohr's salt b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

e. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

f.Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

g. Standardization of sodium thiosulphate using std. potassium dichromate. h. Estimation of copper in a solution

i. Estimation of iodine

E. Complexometric titrations

j. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

k. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals.

2. Estimation of barium chloride solution.

Physical Chemistry Experiments

1. Conductometric titrations- HCl Vs NaOH

2. Potentiometric titrations- Ferrous iron Vs Dichromate

This laboratory based course reinforces the qualitative and quantitative chemical analysis that

the student has learned in the 1st ,2nd , 3rd and 4th semesters

Complementary Chemistry offered to Botany Majors

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .3		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .3		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .3		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .3 CH1432 .3		3×18 =54 2×18 = 36

SYLLABUS FOR COMPLEMENTARY COURSE COURSE
Theoretical Chemistry (Common for Botany/Zoology/Microbiology)
(For Students of Botany Majors)
SEMESTER 1 Complementary Course 1 Course Code-CH1131 .3 Credit-2

L-T-P 2-0-2 36 Hours

Module I – Atomic Structure (9 hrs)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.

Module II – Chemical Bonding (9 hrs)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+

Module III – Analytical Principles (9 hrs)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate.

Module IV – Environmental Chemistry (9 hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion.. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.-Dissolved oxygen-BOD,COD

References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De

4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, “Text book of Qualitative Analysis”
6. A. I. Vogel, “Text book of Quantitative Inorganic Analysis”.
7. S. K. Banerji, “Environmental Chemistry”.
8. A. K. De “Environmental Chemistry - An introduction”
9. B. K. Sharma “Air Pollution”.
10. V. K. Ahluwalia “Environmental Chemistry”
11. G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER I Complementary CourseBotany majors. Course Code -CH1131 .3 THEORETICAL CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the electronic configuration of Copper (atomic umber 29) 2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Short answer type. Answer any 8 questions. Each question carries two marks

11. What is Bohr Bury’s rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr’s theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?
16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?
20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

Short essay. Answer any 6 questions from the following. Each question carries four marks.

23.If the energy difference between two electronic states of hydrogen atom is 214.68 $KJmol^{-1}$. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

Section-D

Essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
    (c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.
    (b) Explain the theory of redox indicators.
    (c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.
34. (a) Write a note on Hydrogen bonding and its consequences.
    (b) How electronic configuration of molecules related to molecular behavior? Explain.
    (c) Explain Fajan's Rule.
35. (a) Discuss the formation and importance of ozone layer.
    (b) What is meant by pollution and pollutants? Explain the classification of air pollutants. (c) What are the sources of important air pollutants.

Complementary Chemistry for BOTANY Majors
SEMESTER II Course code-CH1231 .3 Credit-2
Inorganic and bioinorganic chemistry(Common for Botany/Zoology/Microbiology)
L-T-P 2-0-2 (36 hrs)

Module I :Organometallics (9 hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

Module II Nuclear Chemistry (9 hrs)

Natural radioactivity, modes of decay, Geiger–Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

Module III - Coordination Chemistry (9 hrs)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes. Application of metal complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hrs)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of O2 – CO2 transportation, nitrogen fixation, carbon fixation and carbon cycle. Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems.

References

1. Co-ordination Chemistry – Bosolo and Johns
2. Chemistry of Organometallics – Rochoco.
3. Concise Inorganic Chemistry – J.D. Lee
4. Puri, Sharma and Kalia “Inorganic Chemistry”
5. Modern Inorganic Chemistry A.D. Madan

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER II Complementary CourseBotany majors. Course Code CH1231.3
INORGANIC AND BIOINORGANIC CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the structure of Zeise's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

Short answer type . Answer any 8 questions from the following. Each question carries two marks

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. What are trace elements?

22.What is the role of chlorophil in photosynthesis?

Section-C

Short essay. Answer any 6 questions from the following. Each question carries four marks.

23.Write a note on organotin compounds.

24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.

25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?

26.Explain the relation between nuclear stability and n/p ratio.

27.Write the biological effects of radiation.

28.Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29.Explain the magnetic properties of octahedral complexes with suitable examples.

30.Discuss briefly the biochemistry of iron toxicity and nutrition.

31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)

(b) What are Frankland reagents? Give its significance. (5 marks)

(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)

(b) Give the principle of neutron activation analysis. (5 marks)

(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5 marks) (c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

SYLLABUS OF COMPLEMENTARY COURSE

Physical Chemistry

(For Students of Botany Majors)

SEMESTER III Course-3 Credit-3 Course Code – CH1331 .3

L-T-P 3-0-2 Total: 54 Hours

Module I. Chemical kinetics 9 Hrs

Chemical kinetics, catalysis, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions (derivation of first order only) fractional life time, units of rate constants, influence of temperature on reaction rates, Arrehinius equation, Calculation of Arrhenius parameters, Collision theory, catalysis, different types of catalysis, intermediate compound formation theory and adsorption theory.

Module II -Ionic equilibrium 9 Hrs

Arrhenius, Lowry- Bronstead and lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, He nde rson e quati on, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant .

Module III. Solutions 9 Hrs

Completely miscible liquid pairs, vapour pressure - composition curve, boiling point-composition curve- ideal and non ideal solutions, fractional distillations, azeotropes. Partially miscible liquids - CST, phenol- water, nicotine-water system, Effect of impurities on miscibility and CST, immiscible liquid pairs, steam distillation- Distribution law and its limitations, applications of solvent extractions.

Module IV UV and NMR spectroscopy 9Hrs

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation, concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects. UV-Visible spectra of enes. Calculation of λmax. Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism. Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI .

Module V Dilute solutions: 9hrs

Molarity, molality and molefraction - Colligative property – relative lowering of vapour pressure – elevation in boiling point – depression in freezing point – osmotic pressure – experimental determination of osmotic pressure – Isotonic solution – reverse osmosis - abnormal molecular mass - van't Hoff factor.

Module VI colloids- 9hrs

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation.

References

1. Organic Chemistry of Natural Products, Chatwal,Gurdeep.R, Himalaya Publications
2. Principles of physical chemistry, Puri Shrama Pathania, Vishal
3. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd
4. Elementary organic spectroscopy, Y.R Sharma, S chand & Company
5. Principles of Physical Chemistry, B.R.Puri, R.L.Sharma & Pathania, Vishal Publishing
6. Essentials of Physical Chemistry, B.S. Bahl., G.D. Tuli & Arun Bahl , S.Chand & Co., New Delhi.
7. Simplified Course in Physical Chemistry, R.L. Madan, G.D. Tuli , S.Chand & Co.
8. Chromatography, .B.K .Sharma, GOEL Publishing house, Meerut

University of Kerala

Model Question Paper of BSc Chemistry Programme

2017 Admission onwards

SEMESTER III Complementary Course. Course Code CH1331 .3

(For Students of Botany Majors)

PHYSICAL CHEMISTRY

Time:3hours Maximum Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define pH.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift.
7. Explain chromophore with an example.

8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Define Van't Hoff factor.

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constantof a chemical reaction on the absolute temperature and explain the terms involved. 13.Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?
15. What is critical micelle concentration? Discuss the structure of micelles in polar and nonpolar media
16. Tetra Methy Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Differentiate between molarity and molality.
19. A solution containing 7g of a non volatile solute in 250g of water boils at 373.26 K. Find the molecular mass of the solute.(Kb for water is 0.52K/m)
20. Explain the terms Degree of hydrolysis and hydrolysis constant.
21. Explain reverse osmosis.
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.

24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31x10^{-3}$ s^{-1}. Calculate the half life period of the reaction.

25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = $1.85x10^{-5}$.

26. Derive the relation between K_h, K_w and K_a.

27. Give an account of applications of colloids

28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$

30. What is osmotic pressure? How will you determine the molecular mass of a substance with this method?

31. Explain the principle of Fractional Distillation

(6 X 4 = 24marks)

SECTION – D

(*Answer any 2 question. Each question carries 15 marks*)

32. (a)Differentiate between Molecularity and order of a reaction with examples (5 marks)
    (b) Discuss the Kinetic, optical and electrical properties of colloids (5 marks)
    (c) Explain the protective action of colloids(5 marks)

33. (a) Which of the following has the highest osmotic pressure: 0.1M sucrose, 0.1M acetic acid, 0.1M KCl and 0.1M Na_2SO_4 all in water? Why?
    (b) Why do you get abnormal molecular masses of the substances by using colligative properties of the solution.
    (c) Discuss in detail about the determination of molecular mass of a non volatile compound from elevation in boiling point and depression in freezing point

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples. (b) Define critical solution temperature. Explain systems having upper and lower CST using examples
    (c) Explain the applications of UV spectroscopy

35. (a)Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.
    (b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR spectrum of ethanol molecule.

(15 X 2 = 30marks)

SYLLABUS OF COMPLEMENTARY COURSE

Organic Chemistry (For Students of Botany Majors)

SEMESTER IV Course-4 Credit -3 Course Code CH1431 .3

L-T-P 3-0-2 Total 54 Hours

Module I - Chromatography (9 Hrs)

Outline study of adsorption and partition chromatography, paper , thin layer, ion exchange ,gas chromatography- principle-instrumentation and applications and HPLC - Rf and Rt value – Introduction to zone electrophoresis and capillary electrophoresis.

Module II Amino acids, Proteins (9 hrs)

Amino acids: - Classification, structure and stereochemistry of amino acids, essential and non essential amino acids, zwitter ion, isoelectric point, General methods of preparation and reactions of a - amino acids.

Peptides: structure and synthesis (Carbobenzoxy method, Sheehan method only). Proteins:- Structure of proteins, denaturation and colour reactions.

Nucleic acids: - Classification and structure of DNA and RNA. Replication of DNA, Genetic Codes.Translation- Transcription

Module III Sterochemistry (9 hrs)

Optical Isomerism : Chirality and elements of symmetry – DL notation – Enantiomers – optical isomerism in glyceraldehydes, lactic acid and tartaric acid – Diastereoisomers – mesocompounds – Cahn-Ingold-Prelog rules – R-S notations for optical isomers with one and two asymmetric carbon atoms.- erythro and threo representations. Racemic mixture – resolution – methods of resolution

Module IV Oils, Fats, Detergents, Alkaloids, Vitamins and Terpenes (9 hrs.)

Oils and Fats: - Occurrence and extraction. Common fatty acids, soap, saponification value, iodine value, acid value, Alkaloids: - Extraction and structural elucidation of conine, nicotine and importance of quinine, morphine and codeine. Terpenes: - Essential oils, isolation of citral and geraniol (No structural elucidation) Isoprene and special isoprene rule. Vitamins: - Classification, structure functions and deficiency diseases (structures of vitamin A, B1 and C but no structural elucidation).

Module V Dyes (9hrs)

Theory of colour and constitution, classification of dyes, Natural dyes, indigo- Synthesis of methyl orange, congo red, malachite green, phenolphthalein, Schiffs reagent.

Module VI Drugs (9Hrs)

Classification of drugs- analgesic, antipyretic, antibiotic, hypnotics, suphadrugs, antacids, antimalarials, Synthesis of aspirin, sulphaguanidine, chloramphenicol, Drugs of plant origin anticancer compounds from plants.

References

1. Organic Chemistry of Natural Products, Chatwal,Gurdeep.R, Himalaya Publications
2. Principles of physical chemistry, Puri Shrama Pathania, Vishal
3. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd
4. Elementary organic spectroscopy, Y.R Sharma, S chand & Company
5. Principles of Physical Chemistry, B.R.Puri, R.L.Sharma & Pathania, Vishal Publishing
6. Essentials of Physical Chemistry, B.S. Bahl., G.D. Tuli & Arun Bahl , S.Chand & Co., New Delhi.
7. Simplified Course in Physical Chemistry, R.L. Madan, G.D. Tuli , S.Chand & Co.
8. Chromatography, .B.K .Sharma, GOEL Publishing house, Meerut
9. Text Book of Pharmaceutical Chemistry, . Atherden L.M, Bentley and Driver, Oxford. University Press

University of Kerala

Model Question Paper of BSc Botany Programme

2017 Admission onwards

SEMESTER IV Complementary Chemistry Course Code CH1431 .3

ORGANIC CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. What is meant by Rf value?
2. Define Racemic mixture.
3. Represent the configurations of D and L glyceraldehyde.
4. Give two example of essential aminoacids.
5. Describe a colour test for proteins.
6. Define Iodine value.
7. What are antipyretics?
8. State Special isoprene rule?

9. What is mordant dye? Give one example.
10. Give the deficiency disease of Vitamin C. (10 X 1 =10Marks)

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. Give the principle of adsorption chromatography.
12. What is meant by denaturation of proteins.
13. Discuss the importance of Morphine.
14. Which of the following are optically active ? Why?
    (i)2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane
15. Give four differences between enantiomers and diastereoisomers.
16. Write a note on the different types of RNA and its functions.
17. How are alkaloids extracted from natural sources?
18. Give the classification of Vitamins.
19. What are antacids. Explain.
20. Give the structure of Vitamin A.
21. Name three anticancer compounds from plant.
22. Explain saponification.

(2 X 8 = 16 Marks)SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. Discuss the optical isomerism of tartaric acid.
24. Write a note on DNA replication .
25. Give the synthesis of Tryptophan.
26. What is meant by Isoelectric point of aminoacids.
27. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
28. Give a brief account on Thin Layer Chromatography.
29. Write a note on the methods of isolation of terpenoids. 30.Give the synthesis of Methyl Orange

31.Explain the cleansing action of soap.

(4x6 = 24marks)

SECTION – D

(*Answer any 2 question. Each question carries 15 marks*)

32. (a) Explain Ion exchange Chromatography. (5 marks)
    (b)Give the structure elucidation of Conine. (5 marks)
    (c) Describe the structure of DNA. (5 marks)
33. (a) Discuss briefly the structure of Protein.

(b) Explain Sheehan's method.

(c) Discuss the classification of dyes on the basis of application.

34. (a) What is resolution? Explain different methods of resolution.

(b) What are meso compounds ? Are they optical activite ? Explain with a suitable example.

(c) Discuss the isolation, structure and uses of geraniol.

35. (a) Give the synthesis of the following drugs (i) Aspirin (ii) sulphaguanidine (b) Define Oils and fats and discuss the different methods of extraction .

(c) Write a note on detergents.

(15 X 2 = 30marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY

Course V Course Code CH1432 .3 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science, Biochemistry and Microbiology majors.

Qualitative Analysis

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given.

Organic preparations

1. Acetanilide from aniline
2. Meta dinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

A. Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard
b. Estimation of a strong base and a weak base using standardized HCl
b. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)
d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.
e. Estimation of a strong acid using standardized NaOH

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt b. Estimation of oxalic acid/sodium oxalate

c. Estimation of Mohr's salt d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1st ,2nd , 3rd and 4th semesters

Complementary Chemistry offered to Zoology Majors

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .4		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .4		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .4		3×18 = 54 2×18 = 36

4	3	2	3 4	CH1431 .4 CH1432 .4		3×18 =54 2×18 = 36

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry-I(Common for Botany/Zoology/Microbiology)

(For Students of Zoology Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code-CH1131 .4 Credit-2

L-T-P 2-0-2 36 Hours

Module I – Atomic Structure (9 hours)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.

Module II – Chemical Bonding (9 hours)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+,

Module III – Analytical Principles (9 hours)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Beer- Lambert law- Principles of colorimetry - estimation of Iron and phosphate

Module IV – Environmental Chemistry (9 Hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.Dissolved oxygen-BOD,COD

References

12. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
13. Concise Inorganic Chemistry – J.D. Lee
14. Environmental Chemistry A. K. De
15. Modern Inorganic Chemistry A.D. Madan
16. A. I. Vogel, "Text book of Qualitative Analysis"
17. A. I. Vogel, "Text book of Quantitative Inorganic Analysis".

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
Complementary CourseZoology majors.
SEMESTER I Course Code CH1131 .4 THEORETICAL CHEMISTRY

Time: Three Hours   Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the electronic configuration of Copper (atomic umber 29) 2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is Bohr Bury's rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr's theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?

16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?
18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?
20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

Short essay (not exceed 120 words). Answer any 6 questions from the following. Each question carries four marks.

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
    (c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

(b) Explain the theory of redox indicators.

(c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.

34. (a) Write a note on Hydrogen bonding and its consequences.

(b) How electronic configuration of molecules related to molecular behavior? Explain.

(c) Explain Fajan's Rule.

35. (a) Discuss the formation and importance of ozone layer.

(b) What is meant by pollution and pollutants? Explain the classification of air pollutants.
(c) What are the sources of important air pollutants.

Complementary Chemistry for Zoology Majors
Inorganic Chemistry-I(Common for Botany/Zoology/Microbiology Majors)
SEMESTER II Course code-CH1231 .4 Credit-2
(For Students of Zoology Majors)

L-T- P 2-0-2

36 hours

Module I Organometallics (9 hours)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

Module II : Nuclear Chemistry (9hours)

Natural radioactivity, modes of decay, Geiger –Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

Module III - Coordination Chemistry (9 hours)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties complexes. Application of metal complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hours)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of O2 – CO2 transportation, nitrogen fixation, carbon fixation and carbon cycle. Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems.

References

6. Co-ordination Chemistry – Bosolo and Johns
7. Chemistry of Organometallics – Rochoco.
8. Concise Inorganic Chemistry – J.D. Lee

9. Puri, Sharma and Kalia “Inorganic Chemistry”
10. Modern Inorganic Chemistry A.D. Madan

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
Complementary CourseZoology majors.
SEMESTER II Course Code CH1231.4
INORGANIC AND BIOINORGANIC CHEMISTRY - I(Common for Botany/Zoology/Microbiology)

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the structure of Zeise’s salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner’s Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.

20.Differentiate respiration and photosynthesis.
21.What are trace elements?
22.What is the role of chlorophil in photosynthesis?

Section-C

Short essay (not exceed 120 words). Answer any 6 questions from the following. Each question carries four marks.

23.Write a note on organotin compounds.
24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.
25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?
26.Explain the relation between nuclear stability and n/p ratio.
27.Write the biological effects of radiation.
28.Suggest the structure of $[NiCl_4]$ on the basis of Valence Bond Theory.
29.Explain the magnetic properties of octahedral complexes with suitable examples.
30.Discuss briefly the biochemistry of iron toxicity and nutrition.
31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent.
(b) What are Frankland reagents? Give its significance.
(c) Explain about organosilicon compounds in medicine.

33.(a) Explain carbon dating and rock dating.
(b) Give the principle of neutron activation analysis.
(c) Explain the terms nuclear fission and fusion with suitable examples.

34.(a) Write a note on Crystal Field Theory.
(b) Explain the applications of complexes in qualitative analysis.
(c) Write a brief note on isomerism in coordination complexes.

35.(a) Give brief outline of carbon cycle.
(b) Explain nitrogen Fixation.
(c) Write a short note on hemoglobin.

ORGANIC CHEMISTRY

Complementary Chemistry for ZOOLOGY MAJORS

SEMESTER III Course-3 Credit-3 Course Code – CH1331 .4

L-T-P 3-0-
2Total - 54 hoursModule I – Mechanisms in organic substitution reactions (9 hours)

Electron displacement in organic compounds – Inductive, electromeric and mesomeric effects, influence of inductive effect on acidic and basic properties of organic compounds, hyperconjugation and steric effect. Reaction mechanism - Bond fission, rate determining step, nucleophilic substitution of alkyl halides SN1 & SN2 reactions. Effect of structure on reactivity as illustrated by methyl, ethyl, isopropyl and tertiary butyl groups. Electrophilic addition to ethene and propene –Markownikoff's rule, free radical addition, peroxide effect.

Module II – Stereochemistry (9hours)

Optical isomerism, chirality, recemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism due to restricted rotation. Geometrical isomerism, E and Z nomenclature. Aldoximes and ketoximes.

Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, propane, butane, cyclohexane, axial and equatorial bonds.

Module III – Carbohydrates (9 hours)

Classification, configuration, glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose. Preparation and properties of glucose and fructose - Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected). Mutarotation and epimerization. Conversion of glucose into fructose and viceversa.

Module IV – Amino acid and Proteins (9 hours)

Classification and properties – synthesis of glycine, alanine and tryptophan – polypeptides and proteins, peptide linkage, peptide synthesis, polypeptides, primary,secondary, tertiary and quarternary structure of proteins, test for proteins, Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory – Co-enzymes.

Module V– Nucleic acids and Lipids (9 hours)

RNA, DNA – their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids.

Lipids – Classification oils, fats and waxes, iodine value and saponification value, properties of oils and fats – phospholipids

Module VI – Polymers (9 hours)

Classification with example – natural and synthetic polymers – condensation and addition polymerization. Elastic fibres, thermoplastics and thermosetting plastics. Terpenes – classification, isoprene rule, essential oils, elementary study of citral and geraniol (structure elucidation not required) Rubber - structure – Vulcanisation of rubber – synthetic rubber – neoprene, butyl rubber, Buna S, Buna N

Referances

1. Organic Chemistry Vol I and II – I.L. Finar
2. Biophysical Chemistry – Principles and Techniques – A. Upadhyay. K.Upadhyay& N. Nath 3. Reaction Mechanism in Organic Chemistry – Mukherjee and Singh – Macmillan
4. Physical Chemistry – Rakshit
5. Essentials of Physical Chemistry – Bahl, Tuli & Arun Bahl
6.Principles of Organic Chemistry – M. K. Jain, S. Nagin &Co .

University of Kerala
Model Question Paper of BSc Zoology Major
2017 Admission onwards
SEMESTER IV Complementary Chemistry Course Code CH1431 .4
ORGANIC CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. Which is more acidic acetic acid or trichloro acetic acid? Why?
2. Explain Markonikoff's rule with example
3. Represent the configurations of D and L glyceraldehyde
4. Draw the ring structures of glucose and fructose
5. Define mutarotation
6. Give two example of essential aminoacids .
7. Describe a colour test for proteins
8. Define saponification value
9. Give the name and structure of the base present in RNA but not in DNA.
10. What is vulcanization of rubber?

(1 X 10 =10Marks)

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. Describe hyperconjugative effect with suitable examples
12. Discuss the optical isomerism of tartaric acid.
13. Which of the following are optically active ? Why?
    (i)2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane

14.Give four differences between enantiomers and diastereoisomers.

15. What is meant by denaturation of proteins?
16. Distinguish between mutarotation and epimerization.
17. Classify the carbohydrates on the basis of behavior towards hydrolysis.
18. What are lipids? How will you classify them? 19.Give a test to distinguish RNA and DNA
20. How is terpenes classified?.
21. What is polymerization? Give an example of linear polymers?
22. Draw the structure of geraniol

(2 X 8 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. Explain SN1 and SN2 reactions? Give examples
24. Give an account of inductive effect and show how it is applied to predict the strength of organic acids?
25. Give an account of asymmetric synthesis.
26. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
27. What are essential oils? Explain ts function with examples.
28. How is glucose is converted into fructose and vice- versa?
29. What is meant by Isoelectric point of aminoacids. 30.Classify polymers based on molecular forces

31.Explain the cleansing action of soap.

(4x6 = 24marks)

SECTION – D

(*Answer any2 question. Each question carries 15 marks*)

32. (a) Explain the effect of structure on reactivity.
    (b) Explain electrophilic addition reactions with examples
    (c) What are meso compounds ? Are they optical activite ? Explain with a suitable example.

33. (a) Write notes on different conformations of ethane and cyclohexane
    (b) Give an account of the configurations of monoaccharides (c) Discuss briefly the structure of Protein.

34. (a) Discuss general physical and chemical properties of oils and fats
    (b)Describe the functions of RNA and DNA
    (c)Explain the structure of DNA

35. (a) Give an account of synthetic rubbers

(b) Discuss the classification of polymers on the basis of structure (c) Write a note on detergents.

(15 X 2 = 30marks)

PHYSICAL CHEMISTRY

Complementary Chemistry for ZOOLOGY MAJORS

SEMESTER IV Course-4 Credit-3 Course Code CH1431 .4 L-T-P 3-0-2

Total 54 hours

Module I. Chemical kinetics 9 hours

Chemical kinetics, catalysis, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions (derivation of first order only) fractional life time, units of rate constants, influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters, Collision theory, catalysis, different types of catalysis, intermediate compound formation theory and adsorption theory.

Module II. Ionic equilibrium 9 hours

Arrhenius, Lowry- Bronstead and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, Henderson equation - pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant .

Module III Colloids 9 hours

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation.

Module IV Spectroscopy 9 hours

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation, concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects. UV-Visible spectra of enes. Calculation of λmax. simple applications of UV spectroscopy, conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules, principle of MRI .

Module V- Instrumental methods of Chemical Analysis 9 hours

Principle – instrumentation and applications of Atomic absorption spectroscopy- flame emission spectroscopy- Thermal methods - thermogravimetry (TG) - Differential thermal analysis (DTA) - Gas Chromatography- HPLC – Introduction to zone electrophoresis and capillary electrophoresis.

Module VI Solutions 9 hours

Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures, Raoult's law, vapour pressure- composition and temperature-composition curves, fractional distillation, deviation from Raoult's law, Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST, Theory of steam distillation

Referances

1. Organic Chemistry of Natural Products, Chatwal,Gurdeep.R, Himalaya Publications
2. Principles of physical chemistry, Puri Shrama Pathania, Vishal
3. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd
4. Elementary organic spectroscopy, Y.R Sharma, S chand & Company
5. Principles of Physical Chemistry, B.R.Puri, R.L.Sharma & Pathania, Vishal Publishing
6. Essentials of Physical Chemistry, B.S. Bahl., G.D. Tuli & Arun Bahl , S.Chand & Co., New Delhi.
7. Simplified Course in Physical Chemistry, R.L. Madan, G.D. Tuli , S.Chand & Co. 8.Chromatography, B.K .Sharma, GOEL Publishing house, Meerut

University of Kerala

Model Question Paper for Zoology Major

2017 Admission onwards

SEMESTER IV Complementary Course.IV Course Code CH1431 .4

PHYSICAL CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

(Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark)

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define P^H.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift
7. Explain chromophore with an example.

8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Write a short note on zone electrophoresis

SECTION - B

(*Short answer type. Answer any 8 questions from the following. Each question carries two marks.)*

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constantof a chemical reaction on the absolute temperature and explain the terms involved. 13.Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?
15. What is critical micelle concentration? Discuss the structure of micelles in polar and nonpolar media
16. Tetra Methy Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Explain the working of Hollow Cathod Lamp
19. What is the difference between GC and HPLC?
20. Explain the terms Degree of hydrolysis and hydrolysis constant.
21. What are the conditions at which the solutions deviate from ideal behaviour?
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

(8 X 2 = 16 Marks)

SECTION - C

(*Short essay type. Answer any 6 questions from the following. Each question carries four marks.)*

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31x10^{-3}$ s^{-1}. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4 OH per litre. Kb for NH4OH = $1.85x10^{-5}$.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$
30. Briefly explain TGA taking suitable example
31. Explain the principle of Fractional Distillation

(6 X 4 = 24marks)

SECTION – D

(*Answer any2 question. Each question carries 15 marks*)

32.(a)Differentiate between Molecularity and order of a reaction with examples

(b) Discuss the Kinetic, optical and electrical properties of colloids

(c) Explain the protective action of colloids

33.(a) Discuss the principle and applications of AAS

(b) Distinguish between AAS and FES

(c) Explain the applications of TGA and DTA

34.(a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples.

(b) Define critical solution temperature. Explain systems having upper and lower CST using examples

(c) Explain the applications of UV spectroscopy

35.(a)Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.

(b) The salt ofstrong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR

spectrum of ethanol molecule. (15 X 2 = 30marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V

Course Code CH1432 .4 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science Biochemistry and Microbiology majors

Qualitative Analysis

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene

3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

I.Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

d. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt e. Estimation of oxalic acid/sodium oxalate

f. Estimation of Mohr's salt

g.Estimation of calcium

III.Dichrometry

h. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

i.Estimation of ferric iron by reduction with stannous chloride (internal indicator).

IV.Iodimetry and Iodometry

j. Standardisation of sodium thiosulphate using std potassium dichromate k. Estimation of copper in a solution

l. Estimation of iodine.

V.Complexometric titrations

m. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

n. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals

2.Estimation of barium in barium chloride solution.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that

the student has learned in the 1st ,2nd , 3rd and 4th semesters

Complementary Chemistry offered to Homescience and Biochemistry Majors

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .5		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .5		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .5		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .5 CH1432 .5		3×18 =54 2×18 = 36

Syllabus for complementary courses
(Common for Homescience & Biochemistry)

(for Homescience Majors)
Semester-1 Complementary Course No. - 1 Course Code CH1131.5
Credit-2
Inorganic and Analytical Chemistry L-T-P 2-0-2 36 hrs

Module I –Atomic structure 9 hrs

Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theory-postulates –statement of Bohr energy equation –derivation of spectral frequency from Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four quantum numbers and their significance- Orbital wise electron configuration, energy sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

Module II- Analytical Principles 9 hrs

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems, theory of acid base titrations, permanganometric and dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are to be worked out) .

Module III- Radioactivity and Nuclear Chemistry 9 hrs

Radio active decay series, Radioactive equilibrium, Average life, Half life detection of radio activity-Geiger Muller Counter, Wilson cloud chamber, Units of radioactivity-Curie and Rutherford. Applications of radio activity- in medicine and agriculture, biological effects of radiation, pathological and genetic damage, Units of radiations, Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation and radioactivity, mass defect, binding energy, neutron activation analysis

Module IV- Organometallics and biomolecules 9 hrs

Organometallic compounds –Definition and classification, Biological and environmental aspects of organometallics-organometallics in medicine ,Organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin. References

1. Concise Inorganic Chemistry — J. D. Lee
2. Inorganic Chemistry — Puri and Sharma
3. Chemistry of Organometallics — Rochow
4. Organic Chemistry Vol 2 — I.L. Finar
5. Chemistry of natural products Vol. 1 — Gurdeep Chatwal
6 The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry — R D Madan

Model Question paper for S1 Complementary Chemistry Course - II Semester

1 CH1231 .5 (For Students of Homescience and Biochemistry majors)

Organic Chemistry

Time : Three Hours Total marks : 80

Section – A

(Very short answer questions)

Answer all questions. Each question carries 1 mark

(1×10=10)

1. Give the relationship between wavelength, frequency and velocity of electromagnetic radiation?
2. What is the Rydberg equation for calculating the wave number of radiation?
3. Give Schrodinger equation which describes the behaviour of electron in an atom?
4. Indicator used for the titration between strong base and weak acid?
5. Give two examples of primary standard?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Give two examples of Organomercuric comounds in medicine ?
10. What are organometallic comounds?

Section – B

(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. Calculate the weight of Na_2Co_3 required to prepare250ml N/10 solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes?

Section – C

(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?
25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?

28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine?

Section – D
(Long Essay Questions)

Answer any two. Each question carries 15 marks (15×2=30)

32. Derive the Bohr frequency equation?(10marks)
    b) Explain quantum numbers.
33. a)Write notes on Acid base indicators? (10mark) b)Explain the Permanganometric titration? (5mark)
34. a)What are the applications of radioactivity in medicine and agriculture? (10mark)
    b).What is meant by neutron activation analysis? (5mark)
35. a) Write in detail the classification of Organometallic compounds with examples? (10Mark)
    b) Explain the biological aspects of myoglobin? (5marks)?

Syllabus(Complementary course Chemistry)
(For Students of Homescience Majors)

(Common for Homescience &Biochemistry)SEMESTER 2 Course No. 2
Course Code . CH1231 .5 Credit 2 Organic Chemistry

L-T-P 2-0-2 36 hrs

Module I: Carbohydrates 9hrs

Classification, configuration of glyceraldehydes, erythrose, threose, ribose,2- deoxy ribose, arabinose, glucose, fructose and mannose. Reactions of glucose and fructose Pyranoside structures of glucose and fructose Furanoside structure of fructose (structure elucidation not expected), muta rotation, epimerization, conversion of glucose into fructose and vice versa

Module II Vitamins 9hrs

Classification, source, isolation, physiological function and deficiency diseases caused by Vitamin A1(retinol), A2(axerophthol), Vitamin B-B1 (thiamine), B2(riboflavin and folic acid), B5(niacin), B6(Pyridoxine), B12 (Cyano cobalamine) Vitamin C (ascorbic acid),–Vitamin,D2 (ergocalciferol), Vitamin E (Tochopherols), Vitamin H(biotin) and Vitamin K

Module III :Aminoacids and Proteins 9hrs

Classification,synthesis of glycine, alanine, phenyl alanine and aspartic acid, zwitter ion, isoelectric point,, reactions of aminoacids, peptide linkage, peptide synthesis, polypeptides, primary, secondary, tertiary and quarternary structure of proteins, classification, biological importance and tests for proteins.

Module IV: Enzymes and Hormones 9hrs

Enzymes- Characteristics, classification, factors influencing enzyme action, mechanism of enzyme action, Michaelis –Menton theory, enzyme inhibitors.

Hormones- Introduction, isolation, functions and abnormalities due to oxytocin, thyroxin, adrenalin, glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin References

1. Concise Inorganic Chemistry — J. D. Lee

2. Inorganic Chemistry — Puri and Sharma

3. Chemistry of Organometallics — Rochow

4. Organic Chemistry Vol 2 — I.L. Finar

5. Chemistry of natural products Vol. 1 — Gurdeep Chatwal

6 The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla

7. Modern Inorganic Chemistry — R D Madan

Model Question paper for S2 Complementary Chemistry Course - II Semester 2
CH1231 .5 (For Students of Homescience and Biochemistry majors)

Organic Chemistry

Time : Three Hours — Total marks : 80

Section – A

(Very short answer questions)

Answer all. Each question carries 1 mark. (1×10=10)

1. Write the name of a neutral aminoacid?
2. Give the name of an essential aminoacid?
3. What is peptide linkage?
4. Give the name of a monosaccharide?
5. Write one reaction of glucose?
6. What is a carbohydrates?
7. Give the other name of oxytocin?
8. Give the name of two enzymes?
9. Give two functions of enzymes?
10. Which vitamin is called antihaemorrhagic vitamin?

Section – B

(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?
18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation?

Section – C

(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. What is the reaction of amino acid with nitrous acid?
24. Explain the isoelectric point of an aminoacid?
25. Give the method of synthesis of glycine?
26. What are the factors affecting enzyme action?
27. Give the functions and deficiency diseases of vitaminC ?
28. What is Michaeli's Menton theory of enzyme action?
29. Write a note on Furanoside structure of fructose?
30. How will you convert a glucose into a fructose?
31. Write configuration of glyceraldehydes and erythrose?

Section – D

(Long Essay Questions)

Answer any two. Each question carries 15 marks (2×15=30)

32. a) Explain the structure of protein. (10 marks)
    b) Write a note on the synthesis of aspartic acid (5 marks)
33. a) Write notes on the different types of vitamins. (10 marks)
    b) Explain the deficiency disease caused by vitamin B and D. (5 marks)
34. Discuss about

a) The different types of hormones. (10 marks)
b) Enzyme inhibitors. (5 marks)

35. Write in detail
a) The classification of Carbohydrates. (10 marks)
b) Ergocalciferol (5 marks)

Syllabus (Complementary course Chemistry)
(For Students of Home Science majors)
SEMESTER 3 Course-3 Credit-3 Course Code – CH1331 .5L-T-P 3-0-2

Organic Chemistry II **Total - 54 hrs**

Module 1: Colloids 9hrs

Introduction, dispersed phase, dispersion medium, classification, multi molecular, macromolecular and associated colloids. Preparation - condensation and dispersion methods, purification -dialysis and ultra filtration, properties of colloidal solution-optical, kinetic and electrical properties, coagulation, Hardy-Schultz rule, protective colloid, applications of colloidal systems, emulsions, emulsifiers and cleansing action of soap.

Module 2: Adsorption and Chromatography 9hrs

Adsorption-Adsorbent, adsorbate, desorption, types of adsorption, physical and chemical adsorption, kinds of adsorption, interactions, adsorption of gases and solutions on solids, importance of adsorption phenomena(applications)- adsorption in catalysis, Chromatography-Column, TLC, paper and gas chromatography.

Module 3: Colour and constitution, Dyes 9hrs

Colours, complimentary colours, chromophore-auxochrome theory, modern theory of colours, classification of dyes, preparation and uses of para red and methyl orange, phenolphthalein and fluorescein , Alizarin, malachite green

Module 4: Terpenes 9hrs

Introduction, isolation, occurrence, isoprene rule, classification, physical and chemical properties and uses of citral, geraniol, menthol and camphor. An elementary idea of the structure of natural rubber, synthetic rubber, Buna-N, Buna-S, Neoprene and Thiokol.

Module 5: Alkaloids 9hrs

Occurrence, general methods of isolation, functional group analysis, functional nature of oxygen containing groups -OH,-COOH,-CHO, >C= O groups, nature of nitrogen, Hoffmann exhaustive methylation, structure and physiological actions of coniine, nicotine, quinine, morphine and codeine (structure elucidation is not expected)

Module 6: Polymers 9hrs

Natural and synthetic polymers, preparation and uses of vinyl polymers-PE, PVC, PVA, PS, PVF, PMMA, PTFE, Synthetic fibres-Nylon, Nylon 66,Terylene, Di methyl teraphthalat, polymers in medicine and surgery

References

1.	Chemistry of natural products Vol. 1	Gurdeep Chatwal
2.	The Text Book of Organic Chemistry	P.L Soni, H.M. Chowla
3.	Organic Chemistry Vol 1 & 2	I.L. Finar
4.	The Text Book of Organic Chemistry	Arun Bahl & B S Bahl
5.	Polymer Chemistry	B.K Sharma
6.	Inorganic Polymer Chemistry	G S Misra

Model question paper for S_3
Complementary Chemistry for Home Science
Semester III Course Code CH 1331.5 Course III

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1. What are gels.
2. What is meant by Brownian movement.
3. An alkaloid present in hemlock herb.
4. Enthalpy of adsorption is negative .true or false 5 Name an adsorbent in paper chromatography.
6. What are complimentary colours?
7. Explain chromophore with an example.
8. Draw the structure of citral.
9. How many isoprene units are in sesquiterpenes ?
10. Write any two uses of PVC.

Section B

Answer any 8 questions (Marks-2 for each)

11. Write a note on electrical double layer and zeta potential.
12. Distinguish between coagulation and peptisation.

13 Write a note on Gibb's adsorption isotherm.

14. Write any two applications of adsorption.

15. How will you prepare phenolphthalein?

16.What is mordant dye? Give an example
17.What is Buna rubber?
18. Write the reaction of citral with silver oxide.

19.Draw the structure if morphine.

20. How is the functional nature of OH analysed in alkaloids ?

21. What is Bakelite?
22. Give the structure of Nylon 66.

Section C

Answer any 6 questions (Marks -4 for each)

23.What are micelles. Define critical micelle concentration.

24. What is gold no.explain protective colloid ?

25. What do you understand by physical and chemical adsorption?

26. Explain the isomerism shown by citral and geraniol

27. What is Hoffmann exhaustive methylation
28. Write the structure and physiological actions of nicotine
29. What are terpenes. Discuss isoprene and special isoprene rule.
30. How is polystyrene synthesized?
31. Write a note on polymers in medicine and surgery.

Section D

Answer any 2 questions (Marks -15 for each)

32. a)Explain adsorption chromatography b) Write a note on partition chromatography ?

33.Give preparation and uses of 1)PVC 2)PMMA 3)Terylene 4)PTFE 5)PVF?

34. Discuss the various theory of a) colour b) constitution.

35. a) What are emulsifiers? Explain the cleansing action of soap. b) Explain the Hardy- `

` Schultz rule?

Syllabus (Complementary course Chemistry)
(For Students of Home Science majors)
SEMESTER 4 Course-4 Credit-3Course Code – CH1431 .5Organic and Medicinal Chemistry

L-T-P 3-0-2 **Total- 54 hrs**

Module-1: **Medicinal Chemistry** 9hrs

Chemo therapy-Drugs- Classification, Elementary study of analgesics, antipyretics, antibiotics, antimalarials, sulphadrugs, mode of action of drugs, synthesis of aspirin and paracetamol

Module-2: Food additives 9hrs

Preservatives –Calcium propionate, sodium benzoate and sodiumbisulphite antioxidants-Structure and functions of Butylated hydroxy anisole(BHA), Butylat hydroxy toluene(BHT),Vitamine A,E and C. Artificial sweeteners –Structure and applications of saccharin, aspartame and cyclamate. Emulsifiers-chitin

Module-3: Heterocyclics 9hrs

Introduction, Classification and nomenclature. Isolation, preparation, physical properties, acidic and basic character, addition , substitution, oxidation and resonance structures of of pyrrole, furan, thiophene and pyridine.

Module-4: **Insecticides and pesticides** 9hrs

Insecticides - classification and preparation of compounds like DDT, DDE and BHC. Methoxy chlor, malathion, parathion and carbamates(mention only).

An elementary study of antiseptics, disinfectants, pesticides, rodenticides, herbicides and fungicides.

Module-5:Environmental Chemistry -I 9hrs

Air and soil pollution-Introduction, different types of air and soil pollution, air pollutants SO_2, SO_3, NO,.NO_2 and smog. Acid rains, CO_2, CO, green house effect, O_3, importance of ozone layer, causes and effects of ozone layer depletion. Aerosol, photochemical oxidants, PAN, hydrocarbons, particulates, dust, smoke, asbestos, lead mercury, cadmium. Control of air pollution

Module-6:Environmental Chemistry - II 9hrs

Water pollution-Factors affecting the purity of water, sewage water, Industrial waste, agricultural pollution such pesticides, fertilizers, detergents; treatment of industrial waste, water using activated charcoal, synthetic resins, reverse osmosis and electro dialysis.

References

1.An Introduction to Medicinal Chemistry Graham L Patrick Indian Edn

2.Food Chemistry L. H. Mayer

3. The Text Book of Organic Chemistry P.L Soni, H.M. Chowla

4. Organic Chemistry Vol 1 & 2 I.L. Finar

5. The Text Book of Organic Chemistry Arun Bahl & B S Bahl

6. K. Banerji, "Environmental Chemistry".

7. A. K. De "Environmental Chemistry - An introduction"

8. B. K. Sharma "Air Pollution"

9.G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective

Model question paper for S_4

Complementary Chemistry for Home Science majors
Semester 1V Course Code CH 1331.5 Course IV

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1. What are antimalarials? Give one example?
2. Name a sulpha drug?
3. Write two examples for food preservatives?
4. Draw the structure of aspartame?

5 What are Heterocyclics? And give any one hector cyclic compounds?

6. Give the reaction showing the acidic character of furan?
7. What is DDT, DDE?
8. What is an acid rain?
9. What is a smog ?
10. What are detergents?

Section B

Answer any 8 questions (Marks-2 for each)

11. Name two antibiotics?
12. What is BHT? What are its fuctions?

13 How thiophene is isolated?

14. What is an aerosol? Give an example?
15. What are herbicides and fungicides?
16. How will you control of air pollution?
17. What are photochemical oxidants?
18. What is reverse osmosis?

19.What is meant by green house effect. And name two green house gases?

20. Write two chemicals used for sterilization?
21. What are the uses of methoxychlor?
22. What is chitin?

Section C

Answer any 6 questions (Marks -4 for each)

23.What are the mode of action of drugs?.

24. Give the synthesis of aspirin ?

25. Explain the preparation and properties of furan?

26. What are the different types of pollutants in air?

27. Explain the electro dialysis?

28. How will you synthesis paracetamol?

29. Write of Butylated hydroxy anisole(BHA)?

30. Draw the resonance structure of pyridine?

31. Write a note on disinfectants and rodenticides?

Answer any 2 questions (Marks -15 for each)

32. a) Give an outline of a) air pollution b) soil polution?

33.Write the importance of a)ozone layer b) causes and effects of ozone layer depletion?

34. Write the structure and applications of saccharine, aspartane and cyclamate?

35. a) What are the factors affecting the purity of water. b) Explain the treatment of industrial waste?

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V
Course Code CH1432 .5 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science, Biochemistry and Microbiology majors.

Qualitative Analysis

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given.

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene
3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.
Volumetric Analysis

I.Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. i)Estimation of a strong base and a weak base using standardized HCl

ii)Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

a.Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt b.Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d.Estimation of calcium

II.Dichrometry

a.Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b.Estimation of ferric iron by reduction with stannous chloride (internal indicator).

III.Iodimetry and Iodometry

a.Standardisation of sodium thiosulphate using std potassium dichromate b.Estimation of copper in a solution

c.Estimation of iodine

IV.Complexometric titrations

a.Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution. b.Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals

2.Estimation of barium in barium chloride solution.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1st, 2nd, 3rd and 4th semesters

Complementary Chemistry offered to Biochemistry Majors

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

Chemistry Complementary

Complementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .6		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .6		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .6		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .6 CH1432 .6		3×18 =54 2×18 = 36

Syllabus for complementary courses

(for Bio Chemistry Majors)

Semester-1 Complementary Course No. - 1 Course Code-CH1131 .6Credit-2

Inorganic and Analytical Chemistry 36 hrs

L-T-P 2-0-2

Module I –Atomic structure 9 hrs

Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theory-postulates –statement of Bohr energy equation –derivation of spectral frequency from Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four quantum numbers and their significance- Orbital wise electron configuration, energy sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

Module II- Analytical Principles 9 hrs

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems, theory of acid base titrations, permanganometric and dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are to be worked out) .

Module III- Radioactivity and Nuclear Chemistry 9 hrs

Radio active decay series, Radioactive equilibrium, Average life, Half life detection of radio activity-Geiger Muller Counter, Wilson cloud chamber, Units of radioactivity-Curie and Rutherford. Applications of radio activity- in medicine and agriculture, biological effects of radiation, pathological and genetic damage, Units of radiations, Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation and radioactivity, mass defect, binding energy, neutron activation analysis

Module IV- Organometallics and biomolecules 9 hrs

Organometallic compounds –Definition and classification, Biological and environmental aspects of organometallics-organometallics in medicine ,Organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin. References

1. Concise Inorganic Chemistry — J. D. Lee

2. Inorganic Chemistry — Puri and Sharma

3. Chemistry of Organometallics — Rochow

4. Organic Chemistry Vol 2 — I.L. Finar

5. Chemistry of natural products Vol. 1 — Gurdeep Chatwal

6 The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla

7. Modern Inorganic Chemistry — R D Madan

Model Question paper for S1 Complementary Chemistry Course - II Semester

1 CH1231 .5 (For Students of Biochemistry majors)

Organic Chemistry

Time : Three Hours Total marks : 80

Section – A

(Very short answer questions)

Answer all questions. Each question carries 1 mark (1×10=10)

1. Give the relationship between wavelength, frequency and velocity of electromagnetic radiation?
2. What is the Rydberg equation for calculating the wave number of radiation?
3. Give Schrodinger equation which describes the behaviour of electron in an atom?
4. Indicator used for the titration between strong base and weak acid?
5. Give two examples of primary standard?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Give two examples of Organomercuric comounds in medicine ?
10. What are organometallic comounds?

Section – B

(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. Calculate the weight of Na_2Co_3 required to prepare250ml N/10 solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes?

Section – C

(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?

25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine?

Section – D

(Long Essay Questions)

Answer any two. Each question carries 15 marks (15×2=30)

32. Derive the Bohr frequency equation?(10marks)
    b) Explain quantum numbers.
33. a)Write notes on Acid base indicators? (10mark) b)Explain the Permanganometric titration? (5mark)
34. a)What are the applications of radioactivity in medicine and agriculture? (10mark)
    b).What is meant by neutron activation analysis? (5mark)
35. a) Write in detail the classification of Organometallic compounds with examples? (10Mark)
    b) Explain the biological aspects of myoglobin? (5marks)?

Syllabus for complementary courses

(for Bio Chemistry Majors)

(Common for Homescience &Biochemistry) Semester-II Complementary

Course No. - 1 Course Code-CH1231 .6Credit-2 L-T-P 2-0-2

Module I: Carbohydrates 9hrs

Classification, configuration of glyceraldehydes, erythrose, threose, ribose,2- deoxy ribose, arabinose, glucose, fructose and mannose. Reactions of glucose and fructose Pyranoside structures of glucose and fructose Furanoside structure of fructose (structure elucidation not expected), muta rotation, epimerization, conversion of glucose into fructose and vice versa

Module II Vitamins 9hrs

Classification, source, isolation, physiological function and deficiency diseases caused by Vitamin A1(retinol), A2(axerophthol), Vitamin B-B1 (thiamine), B2(riboflavin and folic acid), B5(niacin), B6(Pyridoxine), B12 (Cyano cobalamine) Vitamin C (ascorbic acid),–Vitamin,D2 (ergocalciferol), Vitamin E (Tochopherols), Vitamin H(biotin) and Vitamin K

Module III :Aminoacids and Proteins 9hrs

Classification,synthesis of glycine, alanine, phenyl alanine and aspartic acid, zwitter ion, isoelectric point,, reactions of aminoacids, peptide linkage, peptide synthesis, polypeptides, primary, secondary, tertiary and quarternary structure of proteins, classification, biological importance and tests for proteins.

Module IV: Enzymes and Hormones 9hrs

Enzymes- Characteristics, classification, factors influencing enzyme action, mechanism of enzyme action, Michaelis –Menton theory, enzyme inhibitors.

Hormones- Introduction, isolation, functions and abnormalities due to oxytocin, thyroxin, adrenalin, glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin References

1. Concise Inorganic Chemistry J. D. Lee

2. Inorganic Chemistry Puri and Sharma

3. Chemistry of Organometallics Rochow

4. Organic Chemistry Vol 2 I.L. Finar

5. Chemistry of natural products Vol. 1 Gurdeep Chatwal

6 The Text Book of Organic Chemistry P.L Soni, H.M. Chowla

7. Modern Inorganic Chemistry R D Madan

UNIVERSITY OF KERALA

Model Question paper for Complementary Chemistry Course - II Semester 2

CH1231 .6 (For Students of biochemistry majors)

Organic Chemistry

Time : Three Hours Total marks : 80

Section – A(Very short answer questions)

Answer all. Each question carries 1 mark. (1×10=10)

1. Write the name of a neutral aminoacid?
2. Give the name of an essential aminoacid?
3. What is peptide linkage?
4. Give the name of a monosaccharide?
5. Write one reaction of glucose?
6. What is a carbohydrates?
7. Give the other name of oxytocin?
8. Give the name of two enzymes?
9. Give two functions of enzymes?

10. Which vitamin is called antihaemorrhagic vitamin?

Section – B
(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?
18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation?

Section – C
(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. What is the reaction of amino acid with nitrous acid?
24. Explain the isoelectric point of an aminoacid?
25. Give the method of synthesis of glycine?
26. What are the factors affecting enzyme action?
27. Give the functions and deficiency diseases of vitamin C ?
28. What is Michaeli's Menton theory of enzyme action?
29. Write a note on Furanoside structure of fructose?
30. How will you convert a glucose into a fructose?
31. Write configuration of glyceraldehydes and erythrose?

Section – D
(Long Essay Questions)

Answer any two. Each question carries 15 marks (2×15=30)

32. a) Explain the structure of protein. (10 marks)
    b) Write a note on the synthesis of aspartic acid (5 marks)
33. a) Write notes on the different types of vitamins. (10 marks)
    b) Explain the deficiency disease caused by vitamin B and D. (5 marks)
34. Discuss about
    a) The different types of hormones. (10 marks)
    b) Enzyme inhibitors. (5 marks)

35. Write in detail
    a) The classification of Carbohydrates. (10 marks)
    b) Ergocalciferol (5 marks)

Syllabus for complementary course
(for Biochemistry Majors)

Semester-3 Course-3 Credit-3Course Code – CH1331 .6Inorganic and Organic Chemistry and Spectroscopy Total - 54hrsL-T-P 3-0-2Module I: Chemical Bonding
9hrs

Energies of bond formation Born-Haber cycle, hybridization and structure of molecules-sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 hybridisation with examples, explanation of bond angle in water and ammonia, VSEPR Theory with regular and irregular geometry , polarity of covalent bond, its relation with electronegativity, electronegativity scale-Paulings and Mullickens approaches, factors influencing polarity, dipole moment, its relation to geometry, hydrogen bond, intra and intermolecular hydrogen bond, its consequence on BP, volatility and solubility, partial covalent character of ionic bond, Fajan's rule

Module II: Coordination Chemistry 9hrs

Nomenclature, coordination number, geometry, chelates, isomerism, structural and stereoisomerism, Valence Bond theory of bonding in octahedral and tetrahedral complexes, high spin and low spin complexes, drawbacks of Valence Bond theory, magnetic properties and application in qualitative and quantitative analysis

Module III :Mechanism in Organic Substitution Reactions 9hrs

Electron displacement in organic molecules, inductive, electromeric and mesomeric effects, hyper conjugation and steric effect , bond fission, rate determining step nucleophilic substitution of alkyl halides, SN1, SN2 reactions, effect of structure on reactivity as illustrated by methyl, ethyl, isopropyl and tertiary groups, aromatic electrophilic substitution
reactions, directive influence Module IV: Stereochemistry
9hrs

Optical isomerism, chirality, racemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism, E and Z nomenclature, aldoxims and ketoxims, rotational isomerism, rotation about carbon – carbon single bond, conformation of ethane, propane, butane, cyclohexane, axial and equatorial bonds

Module V : Spectroscopy – I 9hrs

Regions of electromagnetic spectrum interaction radiation with matter, different types of energy levels in molecules, rotation , vibration and electronic levels, various types of molecular spectra, microwave spectroscopy, spectra of diatomic molecules, expression for rotational energy, selection rules, frequency separation, equation for frequency of vibration, expression for vibrational energy, selection rule, calculation of force constant

Module VI: Hetrocyclics and Alkaloids 9hrs

An outline study of the preparation and propertifs of Furan, Pyrrole, Thiophene, Pyridine, Hoffmans exhaustive methylation, Alkaloids, general method of isolation, general properties, physiological action of alkaloids, conine, morphine and nicotine(no structural elucidation expected) References :

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley
2. Concise Inorganic Chemistry : J. D. Lee, ELBS

3. Inorganic Chemistry : J. E. Huheey
4. Coordination Chemistry : Bosolo and Johns
5. Organic Chemistry : Peter Sykes
6. Organic Chemistry : F. A. Carey, Mc Graw Hill
7. Organic Chemistry : Morrison & Boyd
8. Reaction Mechanism of Organic Chemistry : S. M. Mukherji and S. P. Singh, Mc Millan

9.Spectrscopy Y R Sharma.

10.Advanced Organic Chemistry

:Jerry March

Model Question Paper for Complementary Chemistry for Biochemistry Majors
Semester III Course Code CH 1331.5

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1.What is meant by hybridization?

2. What is the structure of SP_2molecule.
3. What is the geometry of SF_6 ?
4. What is the non-linear hybridisation in octahedral complexes?
5. What are chelates?
6. What is inductive effect?
7. Which is the most stable conformation of ethane?
8. Write the selection rule for vibrational spectrum ?
9. Write an expression for force constant ?
10. Write any two properties of alkaloids? **Section B**

Answer any 8 questions (Marks-2 for each)

11. Explain VSEPR theory?

12. What is meant by structural isomerism?

13 What is meant by hyperconjugation?

14. Write a note on steric effect?
15. Explain the conformation of ethane?
16. What are axial and equatorial bonds?
17. What are ketoximes?
18. What are the various types of molecular spectra?
19. Discuss the various types of energy level in molecule?
20. What are the physiological action of alkaloids? ?
21. Write the properties of nicotin?
22. Write the structure of Thiophene?

Section C

Answer any 6 questions (Marks -4 for each)

23.Explain Pauling's electronegativity scale?
24. Explain using valance bond theory, the bonding in tetra hedral complexes ?
25. What are high spin and low spin complexes?
26. Write in detail about hydrogen bonding?
27. What is Hoffmann's exhaustive methylation?
28. Give the expression for the frequency of vibration in vibrational spectroscopy and explain the terms?
29. Explain asymmetric synthesis with an example?
30. Write a note on the isolation of alkaloids?
31. How will you determine bond length in a molecule using microwave spectra?

Section D

Answer any 2 questions (Marks -15 for each)

32. Explain a) Born- Haber cycle (b) Derive an expression for vibrational energy?
33. a)Explain the magnetic properties of co-ordination compounds b) Explain the methods of resolution?
34. a)What are the difference between SN_1 andSN_2 reaction. b) Effect of the structure of bond reactivity on methyl, ethyl, isopropyl and tertiary groups?
35. a)What are alkaloids b)Explain the preparation and properties of Furan, Pyrrole, Pyridine.

c) Write a note on the Physiological action of morphine, conine?

Syllabus for complementary course
(for Biochemistry students)
Semester-4 Course-4 Credit-3Course Code –CH1431
.6Organic Chemistry and Spectroscopy-II

L-T-P 3-0-2 Total 54hrs

Module I: Chromatography 9hrs

Adsorption and partition chromatography, column, paper and thin layer chromatography, Rf value, applications, gas chromatography, applications, ion- exchange chromatography, applications

Module II :Nucleic acids and Lipids 9hrs

Nucleic acids: RNA and DNA, their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids, Lipids: Classification, oils, fats and waxes, iodine value, saponification value, properties of oils and fats, phospholipids

Module III :Polymers and Terpenes 9hrs

Polymers- Classification with examples- natural and synthetic condensation and addition polymerization, elastic fibre, thermoplastics and thermosetting plastics, Rubber structure, lectrophores of rubber, neoprene, butyl rubber, Buna-S, Buna-N, synthetic polymers, Nylon-6, Nylon-66, Bakelite, elementary idea of the structure of natural rubber, Terpenes- classification, isoprene rule, essential oils, elementary study of citral and geraniol(structural elucidation not required)

Module IV :Biophysical Analysis 9hrs

Osmosis osmotic pressure, isotonic solution, determination of molar mass by osmotic pressure method, reverse osmosis, adsorption – types of adsorption, applications factors influencing adsorption, Langmuir theory of adsorption

Module V: Colloids 9hrs

Properties of colloids , Tyndal effect, ultra microscope, Brownian movement, lectrophoresis, electroosmosis, sedimentation and streaming potential stability of colloids, Zeta potential, Hardy- Schultz protective colloids, gold number, emulsion, gels, application of colloids, delta formation, medicines, sewage disposal, emulsification and cleansing action of detergents and soaps.

Module VI :Spectroscopy II 9hrs

Raman spectroscopy, stokes and antistokes lines, quantum theory of Raman spectrum, advantages and disadvantages of Raman spectrum, rotational Raman, vibrational Raman spectrum, complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnetic field, chemical schift, spin-spin coupling, applications

References :

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley

2. Organic Chemistry, Vol. I &II I. L. Finar, Longman
3. Advanced Organic Chemistry : Jerry March
4. Polymer Chemistry B.K Sharma
5. Bio Physical Chemistry Principles and techniques Avinash Upadhyay.Kakoli Upadhyay.Nirmalendu Nath
6. Spectroscopy B K Sharma
7. Spectroscopy Y R Sharma

Model Questions Semester IV (for Bio chemistry Majors) Course Code CH1431 .6 Course – IV

Organic Chemistry and Spectroscopy II

Time : Three Hours Maximum marks: 80 marks

Section A

Answer all.(answer in one word \ sentence)

1.What is Rf value?
2.The chromatographic method where the components are separated in stacks is called
3.Which sugar is present in RNA?
4.Write the expression of Langmuir's adsorption isotherm 5.Write the expansion of DNA.
6. Name one lipid.
7. Name the components obtained on hydrolysin nucleoprotein.
8. Name the two main types of polymers.
9. W h a t i s Nylon 66 ?
10. Which is the monomer of natural rubber?

Section B

Answer any 8. Each question carries 2 marks (short answer type)

11. What are Stokes and anti Stokes lines?
12. Write in brief "Ion exchange chromatography."
13. What is paper chromatography.
14. What is iodine value ?
15. Explain saponification value.
16. What are terpenes ?
17. Explain the stereochemistry of double bond in natural rubber..
18. What are isotonic solutions ?
19. What is Tyndall effect ?

20. What is Hardy-Schultz rule?
21. Explain mutual exclusion rule ?
22. What is chemical shift? $1 \times 8 = 8$

Section C

Answer any 6. Each question carries 4 marks (short e ssay)

23. Write a note on partition chromatography.
24. Explain biological roles of RNA and DNA.
25. Distinguish between addition and condensation polymerization.
26. Distinguish between thermoplastics and thermosetting plastics.
27. Which are the different types of adsorption and the factors influencing adsorption.
28. Define elecrophoresis and electro osmosis.
29. Explain the terms (1) emulsion (2) gel
30. Explain spin-spin coupling in nmr spectroscopy.
31. Draw the high resolution nmr spectrum of ethanol and explain the peaks.

$4 \times 6 = 24$

Section D

Answer any 2. Each question carries 15 marks (essay)

32. (a)Briefly explain the theory and principle of NMR spectroscopy.
(b) Why Raman spectrum is complementary with IR spectrum.

33. (a) Write a short note on the applications of chromatography. (b) Write a note on the biological role of nucleic acid.

34.(a) How is molar mass determined by osmotic pressure method.
(b) Writ a note on cleansing action of soaps and detergents.

35.(a) Explain in detail the applications of colloids.
(b) Explain isoprene rule with an example. 2x15=30

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY

Course V Course Code CH1432 .6 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science Biochemistry and Microbiology majors

Qualitative Analysis

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – polynuclear hydrocarbons, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given.

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene

3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

I.Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. i)Estimation of a strong base and a weak base using standardized HCl

ii)Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

a.Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b.Estimation of oxalic acid/sodium oxalate
c.Estimation of Mohr's salt

d.Estimation of calcium

III.Dichrometry

a.Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b.Estimation of ferric iron by reduction with stannous chloride (internal indicator).

IV.Iodimetry and Iodometry

a.Standardisation of sodium thiosulphate using std potassium dichromate

b.Estimation of copper in a solution

c.Estimation of iodine

V.Complexometric titrations

a.Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution. b.Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals
2.Estimation of barium in barium chloride solution.

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1st ,2nd , 3rd and 4th semesters

Complementary Chemistry offered to Microbiology Majors

Each Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .7		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .7		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .7		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .7 CH1432 .7		3×18 =54 2×18 = 36

QuestionPaperPatternforTest		
QuestionNo	*Typeof Question*	*Marks*
Part A: 1-2	One word or a sentence	1
Part B: 3-6	2 out of 4; Short Answer	2
Part C: 7-8	1 out of 2; Short Essay	4
Part D: 9-10	1 out of 2; Long Essay	15
		Total = 25

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry(Common for Botany/zoology/Microbiology) (For Students of Microbiology Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code-CH1131 .7 Credit-2

L-T-P 2-0-2 36 hours

Module I – Atomic Structure (9 hrs)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals. Electronic configuration of lanthanides and actinides, Lanthanide contraction

Module II – Chemical Bonding (9 hrs)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+, CO and

HF.

Module III – Analytical Principles (9 hrs)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Principles of colorimetry – estimation of iron and phosphorous.

Module IV – Environmental Chemistry (9hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.Dissolved oxygen-BOD,COD analysis.

References:

1. " Atomic structure and chemical bonding with introduction to molecular spectroscopy" – Manas Chanda
2. " Concise Inorganic Chemistry" – J.D. Lee
3. "Inorganic chemistry", Puri, Sharma and Kalia

4. “A text book of Quantitative analysis” A.I.Vogel
5. “Qunatitative analysis: laboratory manual”: Day & Underwood.
6. “Theoretical Principles of Inorganic Chemistry”: Manku.
7.S. K. Banerji, “Environmental Chemistry”.
8.A. K. De “Environmental Chemistry - An introduction”
9.B. K. Sharma “Air Pollution”.
10.V. K. Ahluwalia “Environmental Chemistry”
11.G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER I Complementary CourseMicrobiology majors. Course Code CH1131.7
THEORETICAL CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the electronic configuration of Copper (atomic umber 29) 2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H_2 molecule.
5. Give the structure of XeO_3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is Bohr Bury's rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr's theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?
16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?
18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?

20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

Short essay (not exceed 120 words). Answer any 6 questions from the following. Each question carries four marks.

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
(c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.
(b) Explain the theory of redox indicators.
(c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.
34. (a) Write a note on Hydrogen bonding and its consequences.
(b) How electronic configuration of molecules related to molecular behavior? Explain.
(c) Explain Fajan's Rule.
35. (a) Discuss the formation and importance of ozone layer.
(b) What is meant by pollution and pollutants? Explain the classification of air pollutants.
(c) What are the sources of important air pollutants.

SYLLABUS OF COMPLEMENTARY COURSE Inorganic & Bioinorganic chemistry (Common for Botany/Zoology/Microbiology) (For Students of Microbiology Majors)SEMESTER II Course Code-CH1231 .7 Credit-2

L-T-P 2-0-2 36 hours

Module I –Organometallics (9 hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

ModuleII – Nuclear Chemistry (9hrs)

Natural radioactivity, modes of decay, Geiger –Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

ModuleIII-Coordination Chemistry (9hrs)

Nomenclature, Coordination number and geometry of chelates – isomerism – structural and stereo isomerism - valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – magnetic properties.

Application of coordination complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hrs)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of O2 – CO2 transportation, nitrogen fixation, carbon fixation and carbon cycle. Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems.

References

1. Co-ordination Chemistry – Bosolo and Johns
2. Chemistry of Organometallics – Rochoco.
3. Concise Inorganic Chemistry – J.D. Lee
4. Puri, Sharma and Kalia “Inorganic Chemistry” 5.Modern Inorganic Chemistry A.D. Madan University of Kerala

Model Question Paper of BSc Chemistry Programme

2017 Admission onwards

SEMESTER II Complementary CourseMicrobiology majors. Course Code CH1231.7

INORGANIC AND BIOINORGANIC CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the structure of Zeise’s salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner’s Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. What are trace elements?
22. What is the role of chlorophil in photosynthesis?

Section-C

Short essay (not exceed 120 words). Answer any 6 questions from the following. Each question carries four marks.

23. Write a note on organotin compounds.

10
3

24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.
25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?
26.Explain the relation between nuclear stability and n/p ratio.
27.Write the biological effects of radiation.
28.Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.
29.Explain the magnetic properties of octahedral complexes with suitable examples.
30.Discuss briefly the biochemistry of iron toxicity and nutrition.
31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)
(b) What are Frankland reagents? Give its significance. (5 marks)
(c)Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)
(b) Give the principle of neutron activation analysis. (5 marks)
(c)Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)
(b) Explain the applications of complexes in qualitative analysis. (5 marks)
(c)Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)
(b) Explain nitrogen Fixation. (5 marks)
(c)Write a short note on hemoglobin. (5 marks)

SYLLABUS OF COMPLEMENTARY COURSE
Organic chemistry (For Students of Microbiology

Majors)SEMESTER III Course Code-CH1331 .7 Credit-3T-P 3-0-2
Total - 54 hrs

Module I – Mechanisms in organic substitution reactions (9 hrs)

Electron displacement in organic compounds – Inductive, electromeric and mesomeric effects, influence of inductive effect on acidic and basic properties of organic compounds, hyperconjugation and steric effect.

Reaction mechanism - Bond fission, rate determining step, nucleophilic substitution of Alkylhalides, SN1& SN2 reactions. Effect of structure on reactivity as illustrated by Methyl, ethyl, isopropyl and tertiary butyl groups. Electrophilic addition to ethene and propene – Markownikoff's rule, free radical addition, peroxide effect.

Module II – Stereochemistry (9 hrs)

Optical isomerism, chirality, recemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism due to restricted rotation. Geometrical isomerism, E and Z nomenclature. Aldoximes and ketoximes.

Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, propane, butane cyclohexane, axial and equatorial bonds.

Module III – Carbohydrates (9 hours)

Classification, configuration, glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose. Preparation and properties of glucose and fructose Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected). Mutarotation and epimerization. Conversion of glucose into fructose and viceversa.

Module IV – Amino acid and Proteins (9 hrs)

Classification and properties – synthesis of glycine, alanine and tryptophan – polypeptides and proteins, peptide linkage, peptide synthesis, polypeptides, primary,secondary, tertiary and quarternary structure of proteins, test for proteins, Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory – Co-enzymes.

Module V : Heterocyclic compounds (9hours)

Heterocyclic systems – 5 membered, 6 membered and condensed systems. Structure of pyrrole, Furan and Thiophene. Electrophilic substitution in pyrrole, Furan and Thiophene. Reactivity and orientation – Structure and properties of pyridine. Electorphilic and nucleophilic substitution reactions in pyridine – Basicity and reduction. Structure of purine and pyramidine bases present in nucleic acids.

Module VI– Nucleic acids and Lipids (9 hrs)

RNA, DNA – their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids.

Lipids – Classification oils, fats and waxes, iodine value and saponification value, properties of oils and fats – phospholipids.

References:

1 . Principles of Organic Chemistry – M. K. Jain, S. Nagin & Co
2. The Text Book of Organic Chemistry – P.L.Soni

3. The Text Book of Organic Chemistry – Arun Bahl & B.S. Bahl
4. Reaction Mechanism in Organic Chemistry – Mukherjee and Singh – Macmillan
5. Organic Chemistry Vol I and II – I.L. Finar
6. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi.

MODEL QUESTION PAPER
SEMESTER III
Complementary Course for Microbiology Majors
COURSE CODE CH1331.7ORGANIC CHEMISTRY

Time: 3 hours Maximum marks: 80

SECTION A

(Answer allquestions. Each question carries 1 Mark)

1)What is heterolytic bond fission?
2) Explain the term rate determining step.
3) Draw the most stable conformer of methyl cyclohexane.
4) Write the epimer of D-Glucose.
5) What are polysaccharides?
6) What are zwitter ions?
7) Relationship between the base sequence in DNA and the amino acid sequence in protein is known as …………….
8) Write the structure of tryptophan.
9) What are heterocyclics? Give examples.
10) Name the purine bases present in DNA. (10x1=10 marks)

SECTION B

(Answer any 8 question. Each question carries 2 Marks)

11) Explain hyper conjugation with an example.
12) Explain Markownikoff's rule with example.
13) What is asymmetric synthesis? Illustrate.
14) Explain racemisation.
15) How will you convert glucose to fructose?
16) Why pyrrole undergoes electrophilic substitution at 3-position.
17) Explain saponification value.
18) What is zwitter ion?
19) Draw the structure of D-Arabinose, D-Ribose, L-Glyceraldehyde and L-Erythrose.
20) Whar are phospholipids?
21) Name the products of hydrolysis of nucleoproteins.
22) Compare the basicity of pyridine and pyrrole.

(8x2=16 marks)

SECTION C

(Answer any 6 question. Each question carries 4 Marks)

23) What is inductive effect? How it influences the acidity of organic acids?
24) Explain the E & Z notation of geometrical isomers with examples.
25) Explain mutarotation and epimerization.
26) Explain the following denaturation and colour reactions of protein.
27) How pyridine is prepared? Explain it important nucleophilic substitution reactions.
28) What are lipids? Give examples. Enumerate their functions.
29) (i) What is peroxide effect? (ii) Draw the different conformers of n-butane.
30) What are enzymes? Give their general characteristics.
31) What is iodine value? Write its importance.

(6x4=24marks)

SECTION D

(Answer any 2question. Each question carries 15 Marks)

32) (a) Discuss the mechanism and influence of structure on SN2 reactions.
(b) Discuss the mechanism of addition of HBr to propene in presence of organic peroxide and in the absence of organic peroxides.
(c) Assign the R and S configuration of D- & L- Lactic acid.
33) (a) What is resolution? Explain any two methods.
(b) Write short notes on (i) the configuration of aldoxime and ketoxime and (ii) Optical isomerism due to restricted rotation.
(c) Discuss the ring structure of glucose.
34) (a) Explain two methods of synthesizing peptides.
(b) Discuss primary and secondary structure of proteins.
(c) Discuss the electrophilic substitution in pyrrole.
35) (a) Describe the classification of oils.
(b) Discuss the structure of DNA.
(c) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine (iii) CH_3OH and dry Conc.HCl.

(2x15=30 marks)

SYLLABUS OF COMPLEMENTARY COURSE

Physical chemistry-(For Students of Microbiology Majors)

SEMESTER IV Course Code-CH1331 .7 Credit-3

T-P 3-0-2 Total - 54

hrs Module I. Chemical kinetics & Enzyme catalysis 9 Hrs

Chemical kinetics, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions - derivation of first order kinetics - fractional life time, units of rate constants, influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters

Enzyme Catalysis: Classification of enzymes.General properties of Enzymes. Mechanism of enzyme action- Enzyme substrate interaction, Activation energy, Rate of reaction and Michaelis constant. MichaelisMenton equation.

Module II - Ionic equilibrium 9 hrs

Arrhenius, Lowry- Bronstead and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant.

Module III - colloids 9hrs

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation

Module IV- Instrumentation Method 9hrs

Ultracentrifuge: Principle and application

Spectroscopic techniques: Principle and applications of UV and Visible spectroscopy – types of electronic transitions, concept of chromophore and auxochrome – red and blue shifts – applications.

NMR spectroscopy – nuclear spin – principle of NMR – chemical shift – spin-spin interation – PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI .

Chromatographic techniques : Principle and application of TLC and HPLC .

Electropheresis: Principle and application of Zone electrophoresis and capillary electrophoresis.

Module V - Thermodynamics - 9 hrs

Basic concepts – System – surroundings – open, closed and isolated systems – Isothermal – isochoric and isobaric process – work – heat – energy – internal energy – Heat capacity at constant volume (Cv) and at constant pressure (Cp) – relation between Cp and Cv – First law– The second law – Enthalpy-Entropy-and Free energy-Criteria for reversible and irreversible process Gibbs –Helmholtz equation, concepts of spontaneous and non spontaneous processes.

Module VI Dilutie solutions: 9hrs

Molarity, molality and molefraction - Colligative property – relative lowering of vapour pressure – elevation in boiling point – depression in freezing point – osmotic pressure – experimental determination of osmotic pressure – Isotonic solution – reverse osmosis - abnormal molecular mass - van’t Hoff factor.

References:

1) Physical Chemistry-Rakshit

2) Principles of Physical Chemistry- Puri,Sharma, Pathania

3) Instrumental methods of Chemical Analysis- B.K.Sharma

4) Essentials Of Physical Chemistry - Arun Bahl & B.S. Bahl

5). Y.R.Sharma, Elementary Organic Spectroscopy, Pearson Education, New Delhi

6) Physical Chemistry- N.M.Kapoor

MODEL QUESTION PAPER SEMESTER IV

Complementary Course for Microbiology Majors

COURSE CODE CH1431.7 PHYSICAL CHEMISTRY

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1)What is unit of second order rate constant?
2) Give an example for enzyme catalysed reaction.
3) What are Arrhenius acids and bases?
4) Calculate the pH of a decimolar HCl.
5) What is sol?
6) What are lyophobic colloids?
7) What are chromophores?
8) How many peaks will you get for 1,2-dibromoethane in its H-NMR spectrum?
9) Define the term isobaric process.
10) What is cryoscopic constant? (10x1=10 marks)

SECTION B

(Answer any 8 question. Each question carries 2 Marks)

11) Prove half life of a first order reaction is independent of initial concentration.
12) Differentiate order and molecularity. 13)Explain the term conjugate pair.
14) Explain the terms Ka, Kb and Kw
15)State and explain Hardy-Schule rule?
16) What is CMC?
17) What is chemical shift?
18) State first law of thermodynamics. Write its mathematical form.
19) Explain the different systems in thermodynamics.
20) What is R_f value? Write any two factor influencing R_f value.
21) A 5.13% solution of cane sugar (M=342) is isotonic with 0.9% solution of unknown solute. Calculate the molar mass of the solute 22)Define the term (i) molarity and (ii) molality.

(8x2=16 marks)

SECTION C

(Answer any 6 question. Each question carries 4 Marks)

23) For the decomposition of a compound, k = 2.46 x $10^{-5}s^{-1}$ at 273K and 1.63 x 10^{-3} s^{-1} at 303K. Calculate the energy of activation of the reaction.
24) What is buffer? Give examples. Explain buffer action with an example.
25) Describe any two methods of purifying colloids.
26) Explain red and blue shifts in UV-Vis spectroscopy.
27) Write the principle and application of zone electrophoresis.
28) Derive the relationship between Cp and Cv.
29) Derive an expression for the isothermal reversible expansion work of an ideal gas.
30) What is van't Hoff factor? What is its application?
31) Describe the experimental determination of osmotic pressure.

(6x4=24marks)

SECTION D

(Answer any 2question. Each question carries 15 Marks)

32) (a) Derive the expression for the rate constant in a first order reaction.
 (b) Discuss the different factors influencing the rate of reaction.
 (c) (i) Explain the general properties of enzymes.
 (ii) Briefly discuss the Michaelis-Menton mechanism of enzyme catalysis.
33) (a) Obtain expression for the hydrolysis constant and degree of hydrolysis for the salt of a strong acid and weak base.
 (b) Discuss the kinetic and optical properties of colloids.
 (c) Write the important applications of colloids.
34) (a) Explain the principle of NMR spectroscopy
 (b) Explain spin-spin interaction taking CHBr2-CH2Br as an example. (c) Explain the principle of HPLC.
35) (a) Free energy change is a measure of spontaneity of reactions. Substantiate the statement.
 (b) What are collogative properties? Mention different types of colligative properties. The lowering of freezing point of benzene was 2.33K when 0.412g of a solute of unknown molar was dissolved in 9.31g of benzene. Calculate the molar mass of the solute. Molal depression constant of benzene is 5.1K/m. (c) Explain the following (i) Reverse osmosis (ii) Applications of UV-Vis spectroscopy.

(2x15=30 marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V
Course Code CH1432 .7 Credit 2 Semesters 1,2,3 & 4For students of Botany, Zoology, Home Science, Biochemistry and
Microbiology majors.

Qualitative Analysis

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given.

Organic preparations

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

A.Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard
b. Estimation of a strong base and a weak base using standardized HCl)

Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.

e. Estimation of a strong acid using standardized NaOH

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt b. Estimation of oxalic acid/sodium oxalate

c. Estimation of Mohr's salt d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1. Estimation of water of hydration in barium chloride crystals

2. Estimation of barium in barium chloride solution.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} semesters.

The scheme of practical examination may be framed by the Board of Examiners.

UNIVERSITY OF KERALA

SCHEME AND SYLLABI OF

COMPLEMENTARY CHEMISTRY COURSES
FOR OTHER

FIRST DEGREE PROGRAMMES
UNDER CBCSS

(PHYSICS, GEOLOGY, BOTANY, ZOOLOGY,
HOMESCIENCE, BIOCHEMISTRY & MICROBIOLOGY)

2020 ADMISSION ONWARDS

COMPLEMENTARY CHEMISTRY COURSES UNDER CBCSS

OFFERED TO OTHER MAJORS

INDEX

UNIVERSITY OF KERALA

COMPLEMENTARY CHEMISTRY COURSES

(OFFERED TO FIRST DEGREE PROGRAMMES)

The Complementary Chemistry Syllabus has been designed to motivate students of other majors of **PHYSICS, GEOLOGY, BOTANY, ZOOLOGY, HOMESCIENCE, BIOCHEMISTRY & MICROBIOLOGY** towards chemistry with a potential to contribute to the academic and industrial requirements of the society, in hand with their major discipline. The new, updated syllabus is in accordance with the OUTCOME BASED EDUCATION (OBE) which aim at acquiring advanced knowledge in different branches of Chemistry, in an interdisciplinary way. The **CORSE OUTCOME (CO)** for each course is specified as **CO1, CO2** etc in terms of cognitive levels achieved by each course.

Complementary Courses in Chemistry aim at certain Programme Specific Outcome (PSO) in consistent with those of the major courses.

PSO1: Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)

PSO2: Develop skill in safe handling of chemicals and glass wares, take precaution against accidents and follow safety measures.

PSO3: Avoid random usage of dangerous chemicals and Use chemicals in a critical way

PSO 4: Acquire a comprehensive knowledge of Chemistry, its impact on human, society and the environment to lead a better life in harmony with nature.

DISTRIBUTION OF HOURS AND CREDITS

TOTAL NUMBER OF SEMESTERS -4

COMPLEMENTARY CHEMISTRY LECTURE COURSES-4

COMPLEMENTARY CHEMISTRY LAB COURSE-1

(Two hours/week in all semesters, One Semester–18 Weeks)

TOTAL CREDITS–14

Semester	Hours per week		Number of Credits	*Course Code	Instructional Hours
	Theory	Lab			
1	2	2	2	CH1131 .1	2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .1	2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .1	3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .1 CH1432 .1	3×18 =54 2×18 = 36

*Applicable to Physics Major

GENERAL ASPECTS OF EVALUATION

MODE OF EVALUATION COMMON TO COMPLEMENTARY COURSES

Evaluation of each course shall involve Continuous Evaluation (CE) with 20 marks and End Semester Evaluation (ESE) with 80 marks.

CONTINUOUS EVALUATION FOR LECTURE COURSES (CE)

The Continuous evaluation will have 20 marks and will be done continuously during the semester. CE components are

(i) Attendance for lecture and laboratory sessions (to be noted separately where both lecture and laboratory hours have been specified within a course);

(ii) Assignment /seminar and

(iii) Test

Components for CE marks

No	Component	Marks
1	Attendance	5
2	Assignment / Seminar	5
3	Tests	10
Total		**20**

EVALUATION OF THE ASSIGNMENTS AND SEMINAR

The topic selection by the student for assignments/seminar will be with the approval of the course teacher

The assignment can be

1. A report of about 4-6 pages in A4 size paper
2. The topic can be presented either as oral or as power point for 10 minutes duration using audio-visual aids if available. The seminar is to be conducted within the contact hour allotted for the course.
3. Preparing Charts on assigned topic
4. Making static or working models.

The submitted report /chart /models should be submitted for assignment marks

QUESTION PAPER PATTERN FOR CONTINIOUS EVALUATION TEST

1. The theory examination has a duration of 1.5 hours
2. Each question paper has three parts: A, B , C
3. Section A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence.
4. Section B contains twelve questions. Out of these twelve questions, the students have to answer 7 questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Section C contains nine questions of which the candidate has to answer 4 questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).

Question paper should contain 20% hard, 60% medium and 20% easy questions

Question Paper Pattern for CE Test		
Question No	Type of Question	Marks
Section A: 1-10	All / one word/one sentence	1X10=10
Section B: 11-22	7out of 12; Short Answer	7 X2=14
Section C: 23-31	4 out of 9; Short Essay	4 X4= 16
TOTAL	1 out of 2; Essay	40 marks

CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation for LAB COURSE will have 20 marks. The ESE of LAB COURSE will be done only in the IV semester. But the correspondinding CE are calculated from all the semesters in which there is attendance for laboratory sessions.

No	Component	Marks
1	Attendance	5
2	Lab test	5
3	Lab report/Record	5
4	Punctuality	5
	Total	**20**

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EVALUATION OF THE RECORD

On completion of each experiment, a report should be submitted to the course teacher. All experiments should be recorded as Lab report in a bound volume. The experimental description should include aim, principle, materials/apparatus required/used, method/procedures and tables of data collected, equations, calculations, graphs, and other diagrams and the final results. The Certified RECORD is compulsory for the LAB COURSE ESE.

CE for Laboratory Record		
No.	**Sub component**	**Marks**
1	Punctual submission and Neat presentation	All four sub-components present &
2	Record of more than 90% experiments in the	

	syllabus	satisfactory 5
3	Calculations and absence of errors/mistakes	Only three : 4
4	Accuracy of the result	Only two : 3 Only one :2

LAB RECORD of experiments certified by the tutor and HoD should be submitted for verification by the External Examiner at the ESE.

END SEMESTER EVALUATIONS (ESE)

QUESTION PAPER PATTERN &

GUIDELINE FOR QUESTION PAPER SETTERS

1. The theory examination has a duration of 3 hours
2. Each question paper has four sections: A, B , C and D
3. Section A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence. Students have to answer all questions.
4. Section B contains twelve questions of which the students have to answer eight questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Section C have nine questions of which the candidate has to answer only six questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).
6. Section D contains four questions of which the candidate has to answer any two. Each question carries **three subdivisions** amounting to a total of 15 marks.
7. The total marks for the entire questions to be answered is 80marks.
8. Question paper should contain 20% Remember, 60% Understanding and 20% application level according to OUTCOME BASED EVALUATION. Question paper setter shall submit a detailed scheme of evaluation along with question paper.

Question Paper Pattern for Test		
Question No	Type of Question	Marks
Section A: 1-10	10 one word/one sentence	10
Section B: 11-22	8 out of 12; Short Answer	16
SectionC: 23-31	6 out of 9; Short Essay	24
Section D: 32-35	2 out of 4; Essay	30
Total		**80 marks**

ESE FOR LAB COURSES

THE SCHEME OF EXAMINATION FOR LAB COURSES MAY BE FRAMED BY THE PRACTICAL CHEMISTRY BOARD OF EXAMINERS.

SYLLABUS OF COMPLEMENTARY CHEMISTRY COURSES

(FOR PHYSICS MAJORS)

DISTRIBUTUIN OF HOURS & CREDITS

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.1	2x18=36
		2	-		2x18=36
II	2		2	CH1231.1	2x18=36
		2	-		2x18=36
III	3		3	CH1331.1	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.1	3x18=54
		2	4	CH1432.1	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR PHYSICS MAJORS

2020 Admission onwards

SEMESTER	I
COURSE	1
COURSE NAME	THEORETICAL AND ANALYTICAL CHEMISTRY
COURSE CODE	CH1131.1
CREDIT	2
L-T-P	2-0-2
TOTAL HOURS	36

CO No.	**COURSE OUTCOME** ***Upon completion of this course, students,***	**Cognitive Level**
1	Discuss the rules for filling electrons in atomic orbitals	U
2	Correlate stability of atom with electronic configuration	U
3	Discuss theories of chemical bonding and their limitations	U
4	Predict geometry of molecules from the type of hybridisation	U,A
5	Recognise fundamentals of thermodynamics and the predict spontaneity of reactions	U,A
6	Derive thermodynamic properties of systems in equilibrium	A

7	Critically select suitable indicators for acid base and redox titrations	E,A
8	Appreciate the application of common ion effect and solubility product in precipitation and intergroup separation of cations	A
9	Discuss the basic principles of paper chromatography and thin layer chromatography	U
10	Solve numerical problems on bond order, molarity, normality and Lattice energy	A

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –PERIODIC CLASSIFICATION OF ELEMENTS (9hrs)

Quantum numbers and their significance,
Concept of orbitals. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals
Electronic configuration and classification of elements in to s,p,d and f blocks.
Periodic properties, Ionisation energy, Electronegativity and Electron affinity. Diagonal relationship.
Important characteristics of representative elements: valency, oxidation states, ionic and covalent bond formation
Important characteristics of transition elements : variable valency and oxidation states, formation of Complex compounds.

MODULE II - CHEMICAL BONDING (9hrs)

Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.
Polarity of covalent bond its relation with electronegativity
Electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity Dipole moment – its relation to geometry.
Hydrogen bond – inter and intra molecular – its consequences on boiling point,volatility and solubility.
Concept of Hybridisation– SP, SP^2, SP^3, dSP^2, dSP^3, SP^3d^2, and SP^3d^3 with examples
Explanation of bond angle in water and ammonia- VSEPR theory, geometry of molecules with bond pairs of electrons , bond pairs and lone pairs of electrons, limitations of VSEPR Theory.
A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O_2,O_2^{2+},O_2^{2-},NO,NO^+,CO and HF.

MODULE–III: THERMODYNAMICS **(9hrs)**

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process.
Heat capacity of gases at constant volume and constant pressure, derivation of
$C_P - C_V = R$.
Second law of thermodynamics, entropy and free energies
Significance of $\Delta G, \Delta H$ and available work
Criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

MODULE IV: ANALYTICAL PRINCIPLES **(9 Hrs)**

Analytical methods in Chemistry – Principles of volumetric analysis, primary standard, standard solution, Calculation of normality,molality and molarity of solutions
Theory of acid - base titrations: Strong acid-Strong Base, Strong acid-weak base, Weak acid Strong base and weak acid-strong base (Explanation with titration curves)
Redox titrations: Permanganometry-Fe2+ and KMnO4 and Dichrometry-Fe2+ and K2Cr2O7, Theory of acid – base and redox indicators.
Inorganic qualitative analysis, common ion effect- solubility product- precipitation and inter group separation of cations. Salting out process
Chromatography- principle and applications of paper and thin layer chromatography.

Text books/References

1. B.R Puri, L R Sharma K C Kalia, Principles of Inorganic Chemistry, Sobhanlal Nagin Chand&Co. New Delhi
2. Manas chanda,Atomic structure and Chemical bonding in molecular spectroscopy,Tata Mc Graw Hill
3. S Glasstone ,Thermodynamics for Chemists,Affiliated Eat West Publishers
4. J D Lee, Concise Inorganic Chemistry, ELBS
5. R P Rastogi and R R Misra, An Introduction to Thermodynamics
6. D.A Skoog, D M West, F J, Holler, S R Crouch, Fundamentals of Analytical Chemistry,8th Edn., Brookes/Cole, Thomson Learning,Inc, USA,2004
7. B K Sharma, Chromatography, Goel Publishing House, Meerut

UNIVERSITY OF KERALA
I Semester B.Sc Degree Examination Model Question Paper
Complementary Chemistry for Physics Major

Course code CH1131.1 Credit 2
THEORETICAL AND ANALYTICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp^3 hybridization?
4. Calculate the bond order of H_2 molecule.
5. What do you mean by solubility product?
6. Give the mathematical expression for first law of thermodynamics.
7. What is the significance of entropy?
8. Define Molality.
9. Which indicator you suggest for the volumetric titration of NH_4OH by HCl?
10. Name a primary standard substance for estimation of NaOH.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Give one example each for the stability of Half filled and fully filled atomic orbitals.
12. Write down the MO configuration of O_2 molecule.
13. Define lattice energy.
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?

16.Mention the rules for adding electrons to molecular orbitals?

17.Explain redox titrations with an example.

18.How would you prepare 100ml of 0.05M Mohr's salt solution?

19.Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20.What is the application of Gibbs Helmholts equation?

21.What is the principle of paper chromatography?

22. What is the theory of pH indicators?

(1x10=10 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Discuss the Born Haber cycle for the formation of NaCl.

24. Identify the hybridization in H_2O and NH_3. How will you account for the geometry of these molecules?

25. Give an account of acid base indicators.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Born-Haber Cycle considering the formation of NaCl as an example.

30. Write a note on spontaneity of a chemical reaction.

31. Explain briefly the principle and application of thin layer chromatography.

(4x6=24 marks)

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. (a) Discuss the basis of periodic classification into different blocks.

(b)What are quantum numbers? Give its significance.

(c) Explain various rules regarding electronic configuration. (5+5+5)

33. a) Define heat capacity of gases at constant temperature and pressure.

How are they related ?

b) What are the criteria for equilibrium? Discuss.

c) Discuss on the work of expansion of an ideal gas in reversible isothermal process. (5+5+5)

34. (a) Write a note on Hydrogen bonding and its consequences.

(b) How electronic configuration of molecules related to molecular behavior? Explain.

(c) Explain Fajan's Rule. (5+5+5)

35. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

(b) Explain the theory of redox indicators.

(c) Calculate the concentration in terms of normality and molarity of a solution of 8g of NaOH in 100 mL NaOH solution. (5+5+5)

(15x2=30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL AND INDUSTRIAL CHEMISTRY**
COURSE CODE	**CH1231.1**
CREDIT	**2**

L-T-P	2-0-2
TOTAL HOURS	36

CO No.	COURSE OUTCOME *Upon completion of this course, students,*	Cognitive Level
1	Define enthalpies of formation, combustion, neutralization, solution and hydration reactions	R,U
2	Apply Hess's law for thermo chemical calculations	A
3	Predict the effect of temperature pressure and concentration on a system in equilibrium based on Le Chatelier principle	U
4	Classify acidic and basic compounds in accordance with different concepts.	U
5	Suggest method for determination of pH	A
6	Discuss petrochemicals and their applications	
7	Realise the depletion of petroleum products and the need for alternate sources of energy.	U
8	Recognise the necessity of sustainable development	U
9	Appreciate the role of solar energy in photosynthesis and discuss methods of solar energy harvesting	U
10	Become responsible in the consumption of natural resourses and avoid factors affecting the harmony of nature from the equilibrium concept.	A
11	Discuss and the Illustrate general methods and techniques in metallurgy	U,A
12	Predict methods of concentration, extraction metals from their ores	A
13	Discuss the applications of Van Arkel method and zone refining in metallurgy	U

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: THERMO CHEMISTRY (9hrs)

Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law as an application of First law of thermodynamicsand its application Bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction. (Numerical problems to be worked out)

MODULE II : CHEMICAL AND IONIC EQUILIBRIUM (9 hrs)

Reversible reactions – K_P, K_C, and K_X and their inter relationships – Free energy change and chemical equilibrium (thermodynamic derivation) Influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

Le Chatelier's principle and the discussion of the above reactions on its basis.

Concepts of Acids and Bases, Arhenius, Lowry-Bronsted, and Lewis concepts.

HSAB Principle. Levelling effect.

pH and its determination by potentiometric method.

Buffer solutions – Henderson equation, Acidic and basic buffers-examples.

Hydrolysis of salts – degree of hydrolysis and hydrolytic constant,

Derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base.

MODULE III : PETROCHEMICALS AND ALTERNATE SOURSES (9hrs)

Petrochemicals:Introduction,Natural gas-CNG,LNG and LPG.

Coal: classification based on carbon content- Carbonisation of coal

Crude oil: constitution and distillation, composition and uses of important Fractions

Ignition point, flash point and octane number-cracking

Usage and depletion of petroleum products.

Need for alternative fuel and Green Chemistry approaches for sustainable development: Introduction, Solar energy harvesting- photosynthesis

Photo voltaic cell, conventional solar cells, nano structured solar cells,

Hydrogen as the future fuel

MODULE IV : METALLURGY (9 Hrs)

General principles of occurrence and extraction of metals

Concentration of ores- roasting, calcination and smelting

General Methods of extracting metal from concentrated ore, examples

Electro metallurgy-Metallurgy of Aluminium, Sodium-Pyrometallurgy

Refining of crude metals: Distillation, Liquation, electrolytic and zone refining

Chromatographic techniques and vapour phase refining (Mond's process and Van Arkel process)

Metallurgy of titanium, cobalt, nickel, thorium and uranium.

TEXT BOOKS /REFERENCES

1. B.R Puri, L R Sharma K C Kalia, Principles of Inorganic Chemistry , S. Chand & Co. New Delhi
2. B.R Puri, L R Sharma M S Pathania, Principles of Inorganic Chemistry , Vishal Publishing Co. New Delhi 2013
3. B K Sharma,H. Gaur, Industrial chemistry, Goel Publishing House, New Delhi
4. K S Tewari,N K Vishnoi, Organic Chemistry, 3rd Edn. Vikas Publishing House

UNIVERSITY OF KERALA
II Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course code CH 1231.1 Credit 2
PHYSICAL AND INDUSTRIAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Write one example for an exothermic reaction

2. Name a natural way of harvesting solar energy.

3. Mention two different forms in which natural gas is available.

4. What do you mean by ionic product of water?

5. Semi conductor grade Silicon is made by the technique--------

6. Identify the Lewis acid (HCl, NaOH, ,BF3,NH3)

7. Name the chemicals which can form an acidic buffer.

8. What is meant by carbonization of coal?

7. Give one example each for a Proton donor and a proton acceptor.

8. Name an oxide ore and a sulphide ore

9. What is the advantage of photovoltaic cell?

10. What is the application of Van Arkel method?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?

12.Give one application of first law of thermodynamics.

13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a

process?

14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) $\longrightarrow$ C_2H_6 (g).

Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.

15. What is bond dissociation energy?
16. What is isochoric process?
17. What are the characteristics of equilibrium constant?
18. What is enthalpy of hydration?
19. What is a reversible process? Give an example.
20. Define Lewis acid and base
21. What is ionic product of water.
22. What is the importance of pyrometallurgy?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Calculate the bond energy of HBr bond,given that the enthalpy of formationof HBr is $-36.2kJmol^{-1}$. The bond energies of H-H and Br-BR bond are $431kJmol^{-1}$ and $188kJmol^{-1}$ respectively.
24. Write a note on HSAB principle.
25. Differentiate between ignition point and flash point.
26. Discuss n Mond's process and Van Arkel method.
27. Write a note on nanostructured solar cells.
28. How will you differentiate between liquation and distillation processes in metallurgy?

29. Give an account of crude oil, its distillation products and theur applications.

30. Comment on the use of hydrogen as a future fuel.

31. What is smelting? Give an example

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. a) Explain pH determination by potentiometric method

(b) Differentiate between hard and soft acid

(c) Write a note on leveling effect of solvents on acids. (5+5+5)

33. (a) Discuss the effect of pressure , temperature and concentration and mention the optimum conditios in the following reaction under equilibrium

i) dissociation of PCl5 into PCl_3 and Cl_2

ii) formation of SO_3 from SO2 and O_2

(b) Illustrate the role roasting and calcinations in metallurgy. (5+5+5)

34. (a) Discuss on spontaneity or feasibility of a process.

(b) State and explain Hesse's law.

(c) When one mole of ethanol melts at its melting point, the entropy change is $29.4 JK^{-1} mol^{-1}$. If enthalpy of fusion of ethanol is $4.6 kJmol^{-1}$, what is the melting point of ethanol?

35. (a) Discuss metallurgy of titanium

(b) Compare between aluminothermy and hydrometallurgy.

(c) Write notes on concentration of an oxide ore and a sulphide ore?

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**PHYSICAL CHEMISTRY**

COURSE CODE	**CH1331.1**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students will:*	**Cognitive Level**
1	Discuss on electrochemical cells and emf measurements	U
2	Apply the principles of physical Chemistry in Catalysis and photochemistry	A
3	Draw unit cells and structure of crystals	U
4	Understand the effect of temperature on molecular velocities of gases	R
5	Calculate cell emf and electrode potentials	A
6	Construct electrochemical cells	A
7	Classify between Photochemical reactions	U
8	Relate electrolyte concentration with emf	E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE 1: GASEOUS STATE **9HRS**

Maxwell's distribution of molecular velocities (No derivation) average, most probable and rms velocities, collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of vander waals constants and critical constants – Law of corresponding states – reduced equation of state, Joule Thomson effect, liquefaction of gases – Linde's and claude's processes

MODULE II – CRYSTALLINE STATE **9HRS**

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc of cubic crystals – Representation of lattice planes of simple cubic crystal - Density from cubic lattice dimension – calculation of Avogadro number - Bragg equation, diffraction of Xrays by crystals – single crystal and powder method. Detailed study of structures of NaCI and KCl crystals.

MODULE III - ELECTRO CHEMISTRY 9HRS

Transport number – definition, determination by Hittorfs method and moving boundary method, application of conductance measurements. Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base.

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, Fuel cells – H_2 – O_2 and hydrocarbon – O_2 type.

MODULE IV – CATALYSIS AND PHOTOCHEMISTRY 9HRS

General Characteristics of catalytic reactions. Different types of catalysis – examples – theories of catalysis (Outline of intermediate compound formation theory and adsorption theory). Enzyme catalysis – Michaelis-Menten mechanism.

Photo Chemistry**:** - Laws of Photo Chemistry, Grothus – Drapter law, Beer Lambert’s law, Einstein’s laws, quantum yield, H_2 – Cl_2 reaction, H_2 – Br_2 reaction – Fluorescence and phosphorescence, chemiluminescence and photo sensitization.

MODULE – V: CHEMICAL KINETICS 9 HRS

Rates of reaction, various factors influencing rates of reactions – order and molecularity – Zero, first, second and third order reaction, derivation of integrated rate equation, fractional life time, units of rate constants, influence of temperature on reaction rates. Arrhenius equation, calculation of Arrhenius parameters – collision theory of reaction rates.

MODULE VI- GROUP THEORY 9 HRS

Group theory- elements of symmetry- proper and improper axis of symmetry- plane of symmetry-center of symmetry- identity elements, combination of symmetry elements- point group- C_{2v}, C_{3v} and D_{3h}- group multiplication table of C_{2v}- determination of point group of simple molecules like water, NH_3, BF_3

REFERENCES

1. B.R.Puri,L.R. Sharma and M.S.Pathania, Principles of Physical Chemistry, 46 th Edn Vishal Publishing Co. NewDelhi
2. J E Huheey, ,E A Keiter, R L Keiter, O K Medhi, Inorganic Chemistry, 4th Edn.Pearson
3. F A Cotton and Wilkinson,Advanced Inorganic Chemistry, John Wiley, New York
4. P L Soni, O P Dharmarsha,U N Dash,Textbook of Physical Chemistry, 23rd Edn, Sultan Chand & Sons, NewDelhi,2011
5. Gurudeep Raj ,Advanced physical chemistry
6. L V Azaroff, Introduction to solids
7. N B Hannay ,Solid state chemistry
8. F Daniel and R A Alberty ,Physical chemistry
9. A Salahuddin kunju and G krishnan Group theory and its applications in chemistry-

UNIVERSITY OF KERALA
III Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course Code CH1331.1 Credit 3
PHYSICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What is the ratio of observed molar volume to ideal molar volume is?
2. Define Boyle temperature?
3. How many unit cell are possible in cubic crystal?

4. Why amorphous solids are said to be isotropic?
5. In a Galvanic cell electron flows from ……… to ………
6. What is the potential of SHE.
7. What is the quantum yield of H_2-Cl_2 reaction?
8. Define chemiluminescence
9. What is the order of the reaction with rate constant $2x10^{-2}$ $molL^{-1}s^{-1}$
10. NH_3 belongs to which point group?

SECTION B

*(Answer **any eight** questions. Each question carries **2** mark)*

11. Define critical temperature and explain its significance?
12. What is virial equation of states?
13. Explain the term Space lattice and Unit cell.
14. Both NaCl and KCl have fcc structures but Kcl behaves towards X-rays like simple cubic lattice. Why?
15. What is liquid junction potential? How can it be eliminated?
16. What are reference electrodes? Give their significance?
17. State Einstein's law of photochemical equivalence?
18. What is meant by chemiluminescence?
19. What is meant by autocatalysis?
20. Define order and molecularity of areaction?
21. A substance decomposes following first order kinetics. The half life period of a reaction is 35 minutes. What is the rate constant of the reaction?
22. What is meant by point group?

SECTION C

*(Answer **any six** questions. Each question carries **4** mark)*

23. What is the law of corresponding states? How is it derived from the vander waal's equation?
24. Calculate the constants a and b, if $Tc=31^0C$, Pc=72.8atm and R=0.082lit atm/K?
25. What are the Miller indices? How are they detrmined?
26. EMF of a standard Daniel Cell is 1.01832 V at 298K. Temperature coefficient of the cell is $-5x10^{-5}$V/K. Calculate ΔG, ΔH, and ΔS of the cell reaction?
27. Write a brief note on Calomel electrode?

28. State and explain Beer-Lambert's law? What are its limitations?

29. Explain pseudo order reactions with suitable examples?

30. Give the group multiplication table for C_{2V}

31. Explain the different symmetry elements?

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Explain Linde's and Claude's method of liquefaction of gases?

    (ii)Do all gases obey gas laws? Discuss some experimental results to explain the deviation and point out the causes which account for this behavior?

    (iii) explain the terms: collision frequency and collision diameter.

33. (i) Derive Bragg's equation for the diffraction of of X-rays by crystal lattice? How is this equation used in elucidating the crystal structure?

    (ii) In fcc lattice of NaCl the distance between Na^+ and Cl^- ions is 281 pm and the density of NaCl is 2.165g/cm^3. Compute Avogadro's no. from the given data. The molar mass of NaCl is 58.5g/mol.

    (iii) Assign the point groups of the molecule BF_3 and H_2O

34. (i) Write a brief note on fuel cells? (ii) State and explain Nernst equation (iii) Explain the principle of potentiometric titrations?

35. (i) What is catalysis? What are the general characteristics of catalyst? (ii) Derive an expression for rate constant of a first order reaction? (iii) Explain the influence of temperature on reaction rates?

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**IV**
COURSE	**3**
COURSE NAME	**SPECTROSCOPY AND ADVANCED MATERIALS**
COURSE CODE	**CH 1431.1**

CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** ***Upon completion of this course, the students will:***	**Cognitive Level**
1	Discuss the principle and applications of rotational, vibrational, electronic and NMR spectroscopy.	U
2	Illustrate isomerism, geometry and bonding in co ordination complexes	A
3	Appreciate the use of co ordination compounds in qualitative and quantitative analysis	U
4	Solve numerical problems relating to nuclear chemistry	R
5	Appreciate the use of biodegradable polymers	A
6	Apply the importance energy and environment conservation	U
7	Get insight to the emerging area of nano and advanced materials	A

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I - SPECTROSCOPY 9hrs

Regions of electromagnetic spectrum – different units to represent energy such as erg, joule, calorie, cm^{-1}, Hz and eV, their interconversions – interaction of radiation with matter, different types of energy levels of molecules – rotation, vibration and electronic levels. Rotation spectroscopy Microwave spectrum of diatomic molecules – expressions for rotational energy, selection rule – frequency separation and determination of bond length – vibrational spectrum – harmonic oscillator, equation for frequency of vibration, expression for vibrational energy, selection rule, frequency separation, calculations of force constant,

Electronic spectroscopy –types of transition and regions where they absorb.

MODULE II- SPECTROSCOPY- II 9 hrs

Raman spectroscopy – stokes and anti stokes lines, quantum theory of Raman spectrum – advantages and disadvantages of Raman spectrum, rotational Raman spectrum, selection rules and frequency separation. Vibrational Raman spectrum – Complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnet, energy spacing, transition between nuclear energy levels in hydrogen nucleus, low resolutionspectrum, chemical shift, spin – spin coupling – fine structure spectrum, application to simple molecule

MODULE III COORDINATION CHEMISTRY 9 hrs

Double salts and complex salts, Werner's coordination theory, Types of ligands,
Chelating ligands- bidentate and polydentate- EDTA, Stability of chelates
Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory
Crystal field theory of octahedral and tetrahedral complexes, examples
high and low spin complexes, magnetic properties ,applications of co ordination compound in qualitative and quantitative volumetric analysis.

MODULE IV – NUCLEAR CHEMISTRY 9 hrs

Nuclear Chemistry – stability of Nucleus – n/p ratio,radioactivity, artificial transmutation and artificial radio activity. Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of pathological and genetic damage due to radiation , Dosimetry – Units – rad, gray and Roentgen. Fricke dosimeter and ceric sulphate dosimeter.

Mass defect, binding energy, atomic fission and fusion

MODULE V :CHEMISTRY OF NANO MATERIALS 9 hrs

Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc.
Nanosystems in nature.
Preparation of Nano particles – Top – down approach and bottom – top approach, sol – gel synthesis, colloidal precipitations, Co- precipitation, combustion technique.

Properties of nano particles: optical, magnetic and mechanical properties.
Tools for measuring nano structure – XRD, Atomic force Microscopy (AFM), Scanning Tunneling Microscopy (STM), and Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM) . Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, Medical applications (use Au, Ag,ZnO and ZnO_2 as examples)

MODULE VI- ADVANCED MATERIALS 9hrs

Magnetic materials-classification- applications and examples
Piezo electric and pyroelectric materials, examples
Conducting polymers- polyacetylene- ployanilines- synthesis- applications
Bio degradable polymers: PLA, PGA and PHBV
Polymeric sulphur nitrogen compounds $(SN)_x$ as one dimensional conductors.
Photoconducting polymers-examples-super conducting materials
Liquid crystals – mesomorphic state, types of liquid crystals, applications and examples.
Ceramics: Introduction, types of clay products, properties and applications

REFERENCE

1. C.N.Banwell, Fundamentals of molecular spectroscopy, Tata Mc GRaw Hill CO. Ltd.
2. B R Puri, L R Sharma and K C Kalia, Principles of Inorganic Chemistry, Mile stone Publishers. New Delhi
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5. F A Cotton and Wilkinson,Advanced Inorganic Chemistry, John Wiley, New York
6. V R Gowarikar,Polymer Chemistry, New Age International (P) Ltd. New Delhi 2010
7. T Pradeep, A Text book of Nanoscience and Nanotechnology,Mc Graw Hill, New Delhi

UNIVERSITY OF KERALA
IV Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course code CH1431.1 Credit 3
SPECTROSCOPY AND ADVANCED MATERIALS

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark*

1. Which of the following give pure rotational spectrum: H_2, N_2, CO_2, HCl?

2. What is Rayleigh scattering?
3. What is the selection rule for vibrational transition?
4. What is the condition for a molecule to be NMR active?
5. What is Wilkinson's catalyst?
6. What is nano shells?
7. Write an example for a chelate.
8. What are the ores of titanium?
9. Name the nano meterial used in semiconductors?
10. What are ferromagnetic materials?

SECTION B

*(Answer **any eight** questions. Each question carries **2** mark)*

11. What is Born Oppenheimer approximation?
12. The force constant of HF molecule is 970Nm-1. Calculate the fundamental vibrational frequency as well as the zero point energy?
13. What is Raman Effect? What is the cause of Raman effect?
14. Explain the terms shielding and deshielding with regard to NMR spectroscopy.
15. What is chemical shift?
16. Explain the effect of solvent in UV spectroscopy.
17. What is the difference between a double salt and a complex compound?
18. $[Fe(CN)_6]^{3-}$ paramagnetic. Why?
19. Give an example for artificial transmutation of elements
20. What is half life?
21. What is STM and its basic principle?
22. Explain the synthesis of polyaniline from aniline.

SECTION C

*(Answer **any Six** questions. Each question carries **4** mark)*

23. Why are anti-stokes lines intense than the stokes lines in the Raman spectrum?
24. Taking the example of HCl show how rotation of the molecule causes dipole moment fluctuations?
25. State and illustrate the Frank-Condon principle.
26. Define the terms: Bathochromic shift, Hypsochromic shift, hyperchromic shift, hypochromic shift.
27. Discuss Werner's theory of coordination compounds.
28. Explain the formation of low spin and high spin complexes with the help of crystal field theory.
29. Write a note on Geiger Muller counter.
30. Explain the properties of nano particles.
31. Give a short note on superconducting materials.

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Derive an expression for allowed energies of rotational levels ina diatomic molecule.
(ii) Show that for a rigid diatomic rotor the moment of inertia is given by $I = \mu r^2$.

(iii) Discuss the quantum theory of Raman spectroscopy

33. (i) Explain the underlying principle in an NMR spectrum.
(ii)What are the different kinds of protons indicated in an NMR spectrum. How do they produce their characteristics signals?

(iii)How can the NMR method be used to distinguish between the structures of

1-propanol and 2-propanol?

34. (i) Give an account of crystal field theory?
(ii) What are applications of coordination compounds in qualitative analysis?

(iii) Radio carbon in wood decays with a half life of 5770 years. What is the rate constant (in $year^{-1}$) for the decay? What fraction would remain after 11540 years?

35. (i) Explain the applications of nanomaterials in electronic and robotics.
(ii) Explain working principle of SEM and TEM.

(iii)Give a note radio active disintegration series.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE	**5**
COURSE TITLE	**COURSE V : LAB COURSE FOR PHYSICS**
COURSE CODE	**CH 1432.1**
CREDIT	**2**

L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** ***Upon completion of this course, the students***	**Cognitive Level**
1	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	E.U
2	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	A
3	Develop skill in observation , prediction and interpretation of reactions	U,A
4	Apply the principle of common ion effect and solubility product in the identification and separation of ions	A
5	Develop skill in weight calculation for preparing standard solutions	A
6	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
7	Determine physical constants	A

I. REACTIONS OF THE FOLLOWING CATIONS:

Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+},b^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^{+}.

II. SYSTEMATIC ANALYSIS OF TWO CATIONS IN A MIXTURE

The cations must be provided in solutions. A student must analyze at least ten mixtures containing two cations each.

III. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardisation of $KMnO_4$ by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

a. Standardization of sodium thiosulphate using std. potassium dichromate.

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV. GRAVIMETRIC ANALYSIS

a. Estimation of water of hydration in barium chloride crystals.

b. Estimation of barium chloride solution.

V. DETERMINATION PHYSICAL CONSTANTS (NOT FOR ESE)

a. Determination of boiling points of common solvents (b.pt range 100^0C- 130^0C)

b. Determination of melting points of organic substances (m.pt range 100^0C- 130^0C)

SYLLABUS OF COMPLEMENTARY CHEMISTRY COURSES

FOR FIRST DEGREE PROGRAMME IN GEOLOGY

Complementary Courses -4 Total Credits – 14

(One Semester – 18Weeks

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery (L)	Lab (P)			
I	2		2	CH1131.2	2x18=36
		2	-		2x18=36
II	2		2	CH1231.2	2x18=36
		2	-		2x18=36
III	3		3	CH1331.2	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.2	3x18=54
		2	4	CH1432.2	2x18=36

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students will:*	**Cognitive Level**
1	Differentiate particle nature and wave nature of matter	U
2	Associate wave concept with microscopic matter	A
3	Understand the relevance of periodic classification of elements	U
4	List various chemical bonds	R
5	Apply the VSEPR theory to explain the geometry of molecules	A
6	Comprehend the meaning of stability of nucleus	U
7	Summarise the applications of radioactivity	U
8	Relate the analytical principles while doing qualitative and quantitative analyses	E

MODULE I –ATOMIC STRUCTURE **9 Hrs**

Atomic spectrum of Hydrogen – different series, Rydberg equation
Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.
Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.
Orbital wise electron configuration, energy sequence rule – Pauli's Principle, Hund's rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING **9 Hrs**

Energetics of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.
Polarity of covalent bond -its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry.
Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.
Hybridisation and structure of molecules – sp, sp^2' sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3 hybridisation with examples- Explanation of bond angle in water and ammonia -
VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations- A brief review of molecular orbital approach
LCAO method – bond order, bond distance and stability of O_2, O_2^{2+},O_2^{2-},NO,NO^+,CO and HF.

MODULE–III: RADIOACTIVITY **9 Hrs**

Radioactive equilibrium (qualitative idea only)-
Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter –
Units of radio activity – Curie and Rutherford –
Radio Carbon dating, Rock dating, Neutron activation analysis -Applications in agriculture and medicine.
A brief study of the biological effects of radiation such as pathological and genetic damage
Dosimetry – Units – Rad, Gray ,Roentgen. Ferrous and Ceric sulphate dosimeters
Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

MODULE IV: ANALYTICAL PRINCIPLES 9 Hrs

Analytical methods in Chemistry –

Principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis- common ion effect- solubility product- precipitation of cations

Chromatography- principle and applications of paper and thin layer chromatography.

REFERENCES

1. Manas Chanda, Atomic structure and chemical bonding with introduction to molecular spectroscopy
2. Puri, Sharma and Kalia, Inorganic chemistry-
3. E S Gilreath, Fundamental concepts of inorganic chemistry-
4. Malik,Tuli, Madan, Selected Topics in Inorganic chemistry, S Chand.
5. F A Cotton, G Wilkinson and P L Guas ,Basic inorganic chemistry-
6. Arnicker ,Elements of nuclear chemistry-
7. A I Vogel, Text book of qualitative analysis-
8. A I Vogel, Text book of quantitative inorganic analysis-
9. Day and Underwood, Quantitative analysis: Laboratory manual

UNIVERSITY OF KERALA

I Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code CH1131.2 Credit 2

THEORETICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?

6. Emission of ------ from a radioactive element does not bring any change in charge or mass.

7. What is the principle of radiocarbon dating?

8. What is the result of the beta emission of group 15 element?

9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.

10. Calculate the normality of 10% NaOH solution.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. State Hund's rule.

12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?

13. Write the Schrodinger wave equation and explain the terms?

14. NH_3 and CH_4 have sp^3 hybridization. Shapes of these molecules are different. Why?

15. Distinguish between intermolecular and intra molecular hydrogen bonding?

16. The bond energy of NO^+ is larger than that of NO. Why?

17. Define Soddy's group displacement law.

18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?

19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?

20. Phenolphthalein is not suitable for the titration of strong acid against weak base. Why?

21. How would you prepare 100ml of 0.05M Mohr's salt solution?

22. What are primary standards? Give two examples.

SECTION C

*(Answer any **six** questions. Each question carries 4 mark)*

23. Why is Bohr model of atom considered inadequate?

24. Explain hydrogen spectrum?

25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?

26. Explain the shape of SF_6 molecule.

27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.

28. Explain neutron activation analysis and its application?

29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.

30. Explain the principle and application of paper chromatography?

31. Explain the theory of redox indicators.

SECTION D

*(Answer any **two** questions. Each question carries 15 mark)*

32. (i) What are quantum numbers? Give the significance of each? (5 marks)

    (ii) Write the postulates of Bohr model of atom? (5 marks)

    (iii) Define Aufbau principle with example and explain the stability of half-filled and fully filled orbital? (5 marks)

33. (i) Write a short note on Born- Haber cycle?

    (ii) Draw and explain the MO diagram for O_2 molecule.

    (iii) Describe the different approaches of electronegativity?

34 (i) Derive an equation for the decay constant of a radioactive material.

    (ii) If at the end of 67.5 years only 3.125% of a radioactive material remains without decay. What is the half life of the decay?

    (iii) Give an example each for proton, neutron and deuteron induced reactions.

35. (i) What are acid base indicators?

    (ii) Explain the use of indicators in acid base titrations.

    (iii) Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1231.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Apply laws of thermodynamics	R
2	Relate spontaneity with entropy and free energy	E
3	Define enthalpy of reactions	R
4	Apply Hess's law	A
5	Illustrate Le Chatelier's principle and predict the effect of pressure and temperature on reactions	A
6	Categorize compounds into acids and bases	A
7	Solve numerical problems on pH and thermodynamic proprties	U,A

MODULE I –THERMODYNAMICS 9 Hrs

First law of thermodynamics- mathematical form- intrinsic energy- enthalpy- reversible, process and maximum work- work of expansion of an ideal gas in reversible isothermal process

Heat capacity of gases at constant volume, at constant pressure, derivation of $C_P - C_V = R$

Second law of thermodynamics- entropy and free energies- significance of ΔG, ΔH and available work – criteria of equilibrium and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation

MODULE II - THERMOCHEMISTRY 9 Hrs

Enthalpies of formation, combustion, neutralization, solution and hydration-

Relation between heat of reaction at constant volume and constant pressure

Variation of heat of reaction with temperature- Kirchoff's equation

Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction

MODULE III – CHEMICAL EQUILIBRIUM **9 Hrs**

Reversible reactions – K_P, K_C, and K_X and their inter relationships –
Free energy change and chemical equilibrium (thermodynamic derivation) –
van't Hoff reaction isotherm and isochore -
Influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

Le Chatelier's principle and the discussion of the above reactions on its basis

MODULE IV–IONIC EQUILIBRIUM **9 Hrs**

Concepts of Acids and Bases-ionization of weak electrolytes-Influence of solvent on acid strength – leveling effect –
pH and its determination - potentiometric method-
Buffer solutions and calculations of the pH- Henderson equation -
Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base

REFERENCES

1. Puri, Sharma and Pathania, Principles of Physical Chemistry
2. Gurudeep Raj, Advanced physical chemistry
3. S Glastone ,Thermodynamics for chemists
4. Glastone and Lewis, Elements of Physical Chemistry
5. K L K Kapoor, A text book of Physical Chemistry
6. P C Rakshit Physical Chemistry

UNIVERSITY OF KERALA

II Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code CH1231.2 Credit 2

PHYSICAL CHEMISTRY

(2020 Admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What is a reversible process?

2. Write the first law of thermodynamics.
3. What is an isochoric process?
4. What is standard enthalpy of formation?
5. Write one example for an exothermic reaction.
6. What is enthalpy of hydration?
7. What is rate constant?
8. What is the significance of ΔG?
9. What is common ion effect?
10. What is the P^H of 0.01M HCl?

SECTION B

*(Answer **any eight** questions. Each question carries **2** marks)*

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?
12. State the first law of thermodynamics. What are its limitations?
13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?
14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) $\longrightarrow$ C_2H_6 (g).Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.
15. Define Enthalpy of formation.
16. What is bond dissociation energy?
17. State Le Chatlier principle.
18. What is isochoric process?
19. What are the characteristics of equilibrium constant?
20. Define Lewis acid and base.
21. What is meant by levelling effect?
22. What is ionic product of water?

SECTION C

*(Answer **any six** questions. Each question carries **4** mark)*

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?

26. State and explain Hesse's law.
27. Derive relation between heat of reaction at constant volume and constant pressure.
28. Calculate the equilibrium constant for a reaction at 25^0C. $\Delta G^0=20kcal$.
29. Predict the effect of pressure on the dissociation of PCl_5.
30. What is meant by Buffer solution? Give an example of acidic and basic buffer solution? Explain its mechanism?
31. Write Henderson equation. What is its significance?

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Derive an expression for work done in the reversible isothermal expansion of an ideal gas.

    (ii) Define

    (a) Work function

    (b) Gibbs free energy function

    (c) Entropy

    (d) Internal energy

33. (i) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.

    (ii) Calculate the heat of formation of CO_2. Given that $CO\ (g)+H_2O\ (l) \Longleftrightarrow CO_2\ (g)+ H_2(g)$; $\Delta H=0.7$ kcal. Heat of formation of H_2O (l) and CO (g) are -68.3 and -26.4 $kcalmol^{-1}$ respectively.

34. (i) Derive van't Hoff equation.

    (ii) Derive relation between Kp and Kc.

    (iii) The equilibrium constant of a reaction doubles on raising the temperature from 25^0C to 35^0C. Calculate ΔH^0 of the reaction?

35. (i) Define pH of a solution. Calculate the pH of 0.2M acetic acid in 0.5M sodium acetate at 298K. Dissociation constant of acetic acid at 298K is 1.8×10^{-5}?

    (ii) Write a note on salt hydrolysis?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	III
COURSE	3
COURSE TITLE	PHYSICAL AND INORGANIC CHEMISTRY
COURSE CODE	CH1331.2
CREDIT	3
L-T-P	3-0-2
TOTAL HOURS	54

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Understand gaseous state	U
2	Interpret the deviation of real gases from ideal behaviour	U & E
3	Get an insight on crystal structure	A
4	Draw and Make crystal models of NaCl & KCl crystals	C
5	Understand chemical cycles of Carbon, Sulphur, Nitrogen and Phosphorous	U
6	Comprehend the properties of various anions, in particular, oxides	A
7	Differentiate true solution, colloidal solution and suspension	E
8	Understand the properties of colloids and their application	U

MODULE I – GASEOUS STATE (9 Hrs)

Maxwell's distribution of molecular velocities (no derivation), average, most probable and RMS velocities

collision number and collision frequency, mean free path

deviation of gases from ideal behaviour – Boyle temperature, derivation of Vander Waal's constants and critical constants

Law of corresponding states – reduced equation of state,

Joule Thomson coefficient, liquefaction of gases –Linde's and Claudes process.

MODULE II –CRYSTALLINE STATE (9 Hrs)

Isotropy and anisotropy – symmetry elements in crystals – seven crystal systems – Miller indices, Bravais lattices, primitive, bcc and fcc lattices of cubic crystals

Bragg equation - diffraction of X rays by crystals – single crystal and powder method

Detailed study of structure of NaCl and KCl crystals

Liquid crystals – mesomorphic state, types of liquid crystals, application and examples

MODULE III– CHEMICAL CYCLES AND GROUP PROPERTIES (9 Hrs)

Carbon, Sulphur, Nitrogen, Phosphorous and hydrologic cycle

Group properties (reactions) of anions in common minerals – Carbonate, Sulphate, Phosphate, Sulphides and Fluorides

Classification of oxides – Acidic, Basic, Amphoteric and neutral

MODULE IV: SURFACE CHEMISTRY AND COLLOIDS (9 Hrs)

Adsorption – types of adsorption of gases by solids, factors influencing adsorption, Freundlich adsorption isotherm – Langmuir adsorption isotherm (derivation not required)

Colloids- True solution, colloidal solution and suspension

Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples

Purification of colloids by electro dialysis and ultra filtration

Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis

Origin of charge and stability of colloids – Coagulation - Hardy Schulze rule – Protective colloids - Gold number

Emulsions- Applications of colloids: Cottrell precipitator – purification of water, coagulation, reverse osmosis, electro dialysis, delta formation, medicines, cleaning action of detergents and soaps.

MODULE V INORGANIC POLYMERS (9 Hrs)

General properties of inorganic polymer-

phosphazenes – preparation of linear and cyclo phosphazene with examples, properties, and application

silicones – general methods of preparation and properties examples

applications of Silicones, Silicone rubber, silicone resins

MODULE VI SOIL AND WATER CHEMISTRY (9 Hrs)

Soil – Composition, mineral matter in soil process of soil formation, weathering – physical (mention), chemical (detail) + biological (mention)

Saline and alkaline soil (brief explanation) Rocks – different types (Igneous, sedimentary and Metamorphic.)

Analysis of lime stone qualitative treatment only

Water Analysis Water quality parameters COD, BOD, main quality characteristics of water (alkalinity, hardness, total solids and oxidation)

Water treatment including chemical (Precipitation, aeration, osonisation, chlorination) and physical methods of sterilization

REFERENCES

1) Rakshit Physical Chemistry
2) Puri,Sharma, Pathania Principles of Physical Chemistry
3) B.K.Sharma, Instrumental methods of Chemical Amalysis
4) Vogel's Text book of Quantitative Chemical Analysis –VI Edition

5) Manas Chanda, Atomic structure with introduction to Molecular Spectroscopy
6) N.M.Kapoor, Physical Chemistry-
7) B.K.Sharma, Soil and Noise pollution-
8. B.K.Sharma, Industrial Chemistry

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code: CH1331 .2 Credit 3

(2020 Admission onwards)

PHYSICAL AND INORGANIC CHEMISTRY

Time: Three Hours **Maximum marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Write the general formula of silica.
2. How oxides are classified?
3. Explain the term mean free path.
4. Name two classification of colloids based on solvent?
5. Explain Bravais lattices
6. Write the expression for RMS velocity.
7. What is inorganic rubber?
8. Define Brownian movement.
9. Define glass transition temperature.
10. Mention any two chemical methods of water sterilization.

SECTION B

(Answer any eight questions. Each question carries 2 marks)

11. Distinguish between most probable velocity and average velocity.

12. State law of corresponding states.
13. Differentiate between isotropy and anisotropy.
14. Find the Miller indices of a crystal plane with intercepts 2a,2b and 3c.
15. Explain COD and BOD.
16. How will you analyse limestone qualitatively?
17. What is CMC
18. Draw Langmuir adsorption isotherm
19. What is the difference between colloid and suspension?
20. Define Boyle temperature.
21. What is Bragg's equation?
22. What is Joule- Thomson coefficient?

SECTION C

(Answer any six questions. Each question carries 4 marks)

23. What are the causes for the deviation of real gases from ideality? How is it solved?
24. Explain symmetry elements in crystals.
25. Give an account of weathering with emphasis to chemical weathering.
26. What are inorganic polymers? How do they differ from organic polymers?
27. Give any one method for the preparation of silicones. What are the important applications of silicones?
28. Explain Hardy Schulze rule with the help of an example.
29. Give an account of carbon cycle.
30. Explain Linde's process of liquefaction of gases.

SECTION D

(Answer any two questions. Each question carries 15 marks)

31. (a) Explain liquid crystals with examples for each type (b) Give a detailed account on the structure of NaCl.
32. Write a note on (a) Nitrogen cycle (b) different types of rocks and (c) main quality characteristics of water.
33. Give an account of the preparation, properties and important applications of (a) silicates (b) phosphazenes.

34. (a) Write a note on different types of adsorption of gases by solids.

(b) Describe the applications of colloids.

35. (a) Write a short note on the various purification methods of water.

(a) Calculate the average velocity and root mean square velocity of a molecule in a sample of oxygen at 0 °C?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	IV
COURSE	4
COURSE NAME	PHYSICAL AND ANALYTICAL CHEMISTRY
COURSE CODE	CH 1431.2
CREDIT	3
L-T-P	3-0-2
TOTAL HOURS	54

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students:*	**Cognitive Level**
1	Discuss metallurgy and metallurgical processes	U

2	Get and insight in to petro chemical industry	U
3	Explain the reaction kinetics	A
4	Understand the theories of catalysis	U
5	Couple different electrode and construct electrochemical cells	U
6	Appreciate the use of sophisticated instruments	A

MODULE I -METALLURGY 9 Hrs

Occurrence of metals, General principles of extraction of metals from their ores:

Concentration of ores- roasting, calcinations and smelting

General methods of extracting metal from concentrated ore Electrometallurgy and Pyrometallurgy

Refining of metals : electrolytic and zone refining only.

Metallurgy of Titanium, Iron, cobalt, Nickel, Thorium, Uranium

Extraction of lanthanides

MODULE II- PETRO CHEMICALS 9 Hrs

Introduction to crude oil, exploratory methods, constitution of crude oil, natural gas – constituents

Distillation of crude oil, separation of natural gas and different fractions

Meaning of terms such as ignition point, flash point, octane number

Types of hydrocarbon fuels and their characteristics

Cracking – catalytic cracking, hydro cracking, isomerization, reforming, sulphur, hydrogen, petroleum, coke and nitrogen compounds from petroleum.

MODULE III - CHEMICAL KINETICS 9 Hrs

Rates of reactions, various factors influencing rates of reactions order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants

Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory of rates

MODULE IV- CATALYSIS AND PHOTO CHEMISTRY 9 Hrs

Theories of catalysis, outline of intermediate compound formation theory and adsorption theory

Photo Chemistry- Laws of photo Chemistry -Grotthus Draper Law, Einstein's law, Beer lambert law

Photo Chemical equivalence and quantum yield, explanation for high and low quantum yields, H_2-Cl_2 reaction, H_2-Br_2 reaction

Photosensitization and Chemiluminescence

MODULE V- ELECTRO CHEMISTRY 9 Hrs

Transport number – definition, determination by Hittorffs method and moving boundary method, application of conductance measurements

Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode

Standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode, concentration cell without transference, Potentiometric titration

Fuel cells – H_2 – O_2 and hydrocarbon – O_2 type

MODULE VI- INSTRUMENTAL METHODS OF ANALYSIS 9 Hrs

Spectral methods – Atomic Absorption Spectroscopy (AAS) principle, measurement, advantages, disadvantages, and applications

Flame Emission Spectroscopy (FES) principle, measurement,(single beam method) applications

Thermal methods: Themogravimetric analysis (TG) principle and method, Factors affecting thermogravimetric analysis, Application, Differential Thermal Analysis (DTA),

principle, method, factors affecting DTA, Applications

REFERENCES

1. Rakshit Physical Chemistry
2. Puri,Sharma, Pathania Principles of Physical Chemistry
3. B.K.Sharma Instrumental methods of Chemical Analysis
4. Vogel's Text book of Quantitative Chemical Analysis –VI Edition
5. Manas Chanda Atomic structure with introduction to Molecular Spectroscopy
6. N.M.Kapoor, Physical Chemistry
7. B.K.Sharma,Industrial Chemistry

Model Question Paper Chemistry (complementary) for Geology majors

Semester IV Course Code: CH1431.2 Course IV Credit 3

(2020 admission onwards)

PHYSICAL AND ANALYTICAL CHEMISTRY

Time: Three Hours **Maximum marks: 80**

SECTION A

Answer all questions. Each question carries 2 marks

1. Write Arrhenius equation.
2. State Beer Lambert law.
3. Explain catalytic cracking.
4. Give an example of a negative catalyst with the chemical reaction which it catalyses.
5. The rate law for a reaction is r = k [A] $[B]^2$. Write the order of the reaction.
6. Define octane number.
7. Name two important ores of Uranium.
8. Draw the shape of graph for the titration of a strong acid Vs strong base.
9. What you meant by flash point?
10. Conductance of an electrolyte depends on ………. and ………..

SECTION B

Answer any eight questions. Each question carries 2 marks

11. What is the influence of temperature on reaction rate?
12. A substance decomposes following first order kinetics. The half life period of the reaction is 35 minutes. What is its rate constant?
13. State Einstein's law of photochemical equivalence.
14. Define quantum yield of a photochemical reaction.
15. Explain van't Hoff reaction isotherm.
16. Illustrate SHE.

17. Write the principle of AAS.
18. How do you differentiate a TG curve from a DTA curve?
19. What is smelting.
20. Distinguish between order and molecularity?
21. What is Grotthus- Draper law?
22. Explain chemiluminescence.

SECTION C

Answer any six questions. Each question carries 4 marks

23. Give the Arrhenius equation. How will you determine the Arrhenius parameters?
24. Explain photosensitization reaction with an example.
25. Explain the method used to determine transport number of an electrolite.
26. What is the principle of flame emission spectroscopy? Mention its important applications.
27. What are the general methods for refining of metals?
28. Give an account of different types of hydrocarbon fuels and their characteristics.
29. Distinguish between isotherm and isochors.
30. Explain quantum yield in terms of H_2-Cl_2 reaction.

Section D. Answer any two questions. Each question carries 15 marks

31. (a) Derive the expression for the rate constant of a first order reaction. (b) How will you express the units of rate constant for reactions of order 1, 2 and 3?
32. Write a note on (a) Extraction of lanthanides (b) Types of hydrocarbon fuels and their characteristics (c) Photosensitization.
33. Give a detailed account on the principle and applications of (a) TG and (b) DTA.
34. (a) Discuss the principle, measurement and applications of Flame Emission Spectroscopy (FES) (b) Explain Collision theory of rates.
35. (a)Explain the method used to determine transport number of an electrolyte.

    (b) A solution of silver nitrate containing 12.14 g of silver in 50 ml of solution was electrolysed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, while 1.25 g of metallic silver was deposited on the cathode. Calculate the transport number of Ag^+ and NO_3^- ions.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE	**5**
TITLE	**COURSE V : LAB COURSE FOR GEOLOGY**
COURSE CODE	**CH 1432.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	A
	Develop skill in observation , prediction and interpretation of reactions	A
	Apply the principle of common ion effect and solubility product in the identification and separation of ions	A
	Develop skill in weight calculation for preparing standard solutions	U,E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Determine pH of soil and water samples	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR GEOLOGY MAJORS)

Course Code CH1432 .2 Credit 2

IV. REACTIONS AND ANALYSIS OF CATIONS : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+},b^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^{+}.

The cations must be provided in solutions. A student must analyze at least ten mixtures containing two cations each.

II. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardisation of $KMnO_4$ by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

a. Standardization of sodium thiosulphate using std. potassium dichromate.

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

III. GRAVIMETRIC ANALYSIS

IV. Estimation of water of hydration in barium chloride crystals.

b. Estimation of barium chloride solution.

IV. pH DETERMINATION (NOT FOR ESE)

Measurement of pH of soil and water samples using pH meter.

COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

Complementary Courses -4 Total Credits – 14

(One Semester – 18Weeks)

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.3	2x18=36
		2	-		2x18=36
II	2		2	CH1231.3	2x18=36
		2	-		2x18=36
III	3		3	CH1331.3	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.3	3x18=54
		2	4	CH1432.3	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF BOTANY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**2**
COURSE TITLE	**ANALYTICAL AND ENVIRONMENTAL CHEMISTRY**
COURSE CODE	**CH1131.3**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students ,*	**Cognitive Level**
1	Discuss Bohr atom model and represent electronic configuration of elements	U
2	Predict structure of simple molecules based on the concept of hybridisation	A
3	Identify hydrogen bonding in relation to physical and chemical properties	U
4	List the various chemical bonds	R

5	Apply the VSEPR theory to explain the geometry of molecules	A
6	Discuss the theory of volumetric analysis	U
7	Become aware of threat of chemical pollutants air ,water and soil	A

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –ATOMIC STRUCTURE (9 Hrs)

Atomic spectrum of Hydrogen – different series, Rydberg equation

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.

Orbital wise electron configuration, energy sequence rule – Pauli’s Principle, Hund’s rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING (9 Hrs)

Energetics of bond formation –Born Haber cycle

Hybridisation and structure of molecules – sp, sp^2’ sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3

hybridisation with examples- Explanation of bond angle in water and ammonia

VSEPR theory with regular and irregular geometry

Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility

Partial covalent character of the ionic bond- Fajan’s rules-

A brief review of molecular orbital approach-

LCAO method – bond order, bond distance and stability of O_2, O_2^{2+},O_2^{2-},NO,NO^+

MODULE III: ANALYTICAL PRINCIPLES (9 Hrs)

Principles of volumetric analysis- primary standard - standard solutions- normality and molarity - theory of acid - base titrations, permanganometric and dichrometric titrations, iodometric and complexometric titrations-

Theory of acid – base and redox indicators-

Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate

MODULE IV – ENVIRONMENTAL CHEMISTRY (9 Hrs)

Nature of environmental threats and role of chemistry-

Green house effect, ozone layer and its depletion-

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis

Dissolved oxygen-BOD, COD

Text Books / References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, "Text book of Qualitative Analysis"
6. A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
7. S. K. Banerji, "Environmental Chemistry".
8. A. K. De "Environmental Chemistry - An introduction"
9. B. K. Sharma "Air Pollution".
10. V. K. Ahluwalia "Environmental Chemistry"
11. G.W. van Loon and S. J. Duffy "Environmental Chemistry: A global perspective"

UNIVERSITY OF KERALA

First semester B.Sc Degree Examination Model question paper

Complementary course for Botany Majors

Course Code CH1131.3 Credit 2

(2020 admission onwards)

ANALYTICAL AND ENVIRONMENTAL CHEMISTRY

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is Bohr Bury's rule?

12. Write down the Schrodinger Equation and explain the terms involved.

13. Explain the failures of Bohr's theory?

14. What are the limitations of VSEPR Theory?

15. What are polar and non polar covalent bonds?

16. Mention the rules for adding electrons to molecular orbitals?

17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?

19. Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20. Which are the green house gases? Mention their sources.

21. What is reverse osmosis? How it is useful in the purification of waste water?

22. What are chief factors responsible for water pollution?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol-1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?

24. Explain the stability of half filled and completely filled orbitals.

25. Give an account of permanganometric titrations.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION D

(Answer any ***two*** *questions. Each question carries 15 marks)*

32. (a) Discuss Bohr Theory, highlighting its merits and demerits.

    (b)What are quantum numbers? Give its significance.

    (c) Explain various rules regarding electronic configuration.

33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

    (b) Explain the theory of redox indicators.

    (c) Explain Beer's Law, Lambert's Law and Beer – Lambert Law.

34. (a) Write a note on Hydrogen bonding and its consequences.

    (b) How electronic configuration of molecules related to molecular behavior? Explain.

    (c) Explain Fajan's Rule.

35. (a) Discuss the formation and importance of ozone layer.

    (b) What is meant by pollution and pollutants? Explain the classification of air pollutants.

    (c) What are the sources of important air pollutants?

UNIVERSITY OF KERALA

Complementary Chemistry for Botany Majors

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**INORGANIC & BIOINORGANIC CHEMISTRY**
COURSE CODE	**CH1231.3**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Understand the biological and environmental aspects of organic compounds	U
2	Comprehend the meaning of stability of nucleus	R
3	Summarise the applications of radioactivity	U
4	Predict the properties of transition metal complexes	A
5	Apply complexation reactions in qualitative and quantitative analysis	U

6	Appreciate biological processes like photosynthesis, respiration etc	E
7	Realise the use of trace elements in biochemical processes	A

R-Remember, U-Understand, A-Apply, E-Evaluate

MODULE I :ORGANOMETALLICS (9 Hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications

Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses

Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture

Environmental aspects of Organometallic compounds

MODULE II NUCLEAR CHEMISTRY (9 Hrs)

Natural radioactivity, modes of decay, Geiger–Nuttal rule-

Artificial transmutation and artificial radioactivity-

Nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion-

Applications of radioactivity- ^{14}C dating, rock dating, neutron activation analysis and isotope as tracers

MODULE III - COORDINATION CHEMISTRY (9 Hrs)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism

Valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes

Application of metal complexes in qualitative and quantitative analysis

MODULE IV – BIO INORGANIC COMPOUNDS (9 Hrs)

Metalloporphyrins – cytochromes –

Chlorophyll - photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of O_2 – CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

TEXT BOOKS /REFERENCES

1. Bosolo and Johns, Co-ordination Chemistry
2. Rochoco,Chemistry of Organometallics
3. J.D. Lee ,Concise Inorganic Chemistry
4. Puri, Sharma and Kalia, "Inorganic Chemistry"
5. A.D. Madan ,Modern Inorganic Chemistry

II Semester B.Sc Degree Examination Model question paper

Complementary Course for Botany Majors

Course Code CH1231.3 Credit 2

INORGANIC AND BIOINORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Give the structure of Zeisel's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of $K_3[Co(NO_2)_4Cl_2]$
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?

14. Explain Geiger Nuttal Rule.

15. What are half life period and average life period?

16. Define mass defect and binding energy.

17. Write the postulates of Werner's Coordination Theory.

18. What are poly dentate ligands? Give an example.

19. Explain the colours of transition metal complexes.

20. Differentiate respiration and photosynthesis.

21. What are trace elements?

22. What is the role of chlorophil in photosynthesis?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Write a note on organotin compounds.

24. Write a brief note on the applications of organometallic compounds in agriculture and horticulture.

25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?

26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss briefly the biochemistry of iron toxicity and nutrition.

31. Metal ions play a variety of roles in biological systems. Explain.

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)

(b) What are Frankland reagents? Give its significance. (5 marks)

(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)

(b) Give the principle of neutron activation analysis. (5 marks)

(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5 marks)

(c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

UNIVERSITY OF KERALA

COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**4**
COURSE TITLE	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1331.3**

CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Classify reactions on the basis of order and molecularity	A
2	Understand the effect of temperature on reaction rates	U
3	Understand the theories of catalysis	U
4	Categorize compounds into acids and bases	U
5	Discuss the principle and application of UV and NMR spectroscopy.	U & A
6	Understand the properties of colloids and their application	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I - CHEMICAL KINETICS 9 Hrs

Rates of reactions, various factors influencing rates of reactions

order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory

Catalysis- Different types of catalysis- intermediate compound formation theory and adsorption theory

MODULE II–IONIC EQUILIBRIUM **9 Hrs**

Concepts of Acids and Bases-ionization of weak electrolytes-Influence of solvent on acid strength – leveling effect –

pH and its determination - potentiometric method-

Buffer solutions and calculations of the pH- Henderson equation -

Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base

MODULE II–SOLUTIONS **9 Hrs**

Completely miscible liquid pairs, vapour pressure - composition curve, boiling point-composition curve- ideal and non ideal solutions, fractional distillations, azeotropes

Partially miscible liquids - CST, phenol- water, nicotine-water system- Effect of impurities on miscibility and CST,

Immiscible liquid pairs, steam distillation- Distribution law and its limitations, applications of solvent extractions.

MODULE IV - UV AND NMR SPECTROSCOPY **9 Hrs**

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation-

Concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects.

UV-Visible spectra of enes - Calculation of λmax

Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH

Principle of MRI

MODULE V DILUTE SOLUTIONS **9 Hrs**

Molarity, molality and mole fraction

Colligative property – relative lowering of vapour pressure – elevation in boiling point – depression in freezing point – osmotic pressure – experimental determination of osmotic pressure – Isotonic solution – reverse osmosis - abnormal molecular mass - van't Hoff factor.

(Numerical Problems to be worked out)

MODULE VI COLLOIDS- **9 Hrs**

Colloidal state- Types of colloids

Preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids

Ultra microscope, Electrical double layer and zeta potential

Coagulation of colloids, Hardy-Schulz rule

Micelles and critical micelle concentration, sedimentation

Application of colloids – Cottrell precipitator, purification of water and delta formation

REFERENCES

1. Chatwal,Gurdeep.R Organic Chemistry of Natural Products, , Himalaya Publications
2. Puri Shrama Pathania Principles of Physical chemistry, , Vishal
3. P.S. Kalsi,Chemistry of natural products, New Age International Private Ltd
4. Y.R Sharma, Elementary organic spectroscopy, S chand & Company
5. B.R.Puri, R.L.Sharma & Pathania Principles of Physical Chemistry, Vishal Publishing
6. B.S. Bahl., G.D. Tuli & Arun Bahl ,Essentials of Physical Chemistry, , S.Chand & Co., N Delhi.
7. R.L. Madan, G.D. Tuli Simplified Course in Physical Chemistry, , S.Chand & Co.
8. B.K .Sharma ,Chromatography, GOEL Publishing house, Meerut

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary course for Botany Majors

Course Code CH1331.3 Credit 3

PHYSICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define pH.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift.
7. Explain chromophore with an example.
8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Define Van't Hoff factor.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constant of a chemical reaction on the absolute temperature and explain the terms involved.
13. Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?

15. What is critical micelle concentration? Discuss the structure of micelles in polar and non polar media
16. Tetra Methyl Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Differentiate between molarity and molality.
19. A solution containing 7g of a non volatile solute in 250g of water boils at 373.26 K. Find the molecular mass of the solute.(Kb for water is 0.52K/m)
20. Explain the terms: Degree of hydrolysis and hydrolysis constant.
21. Explain reverse osmosis.
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst?
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31 x 10^{-3}$ s^{-1}. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = $1.85x10^{-5}$.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electro-dialysis techniques used for the purification of colloids
29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$
30. What is osmotic pressure? How will you determine the molecular mass of a substance with this method?
31. Explain the principle of Fractional Distillation

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. (a)Differentiate between Molecularity and order of a reaction with examples (5 marks)

    (b) Discuss the Kinetic, optical and electrical properties of colloids (5 marks)

    (c) Explain the protective action of colloids(5 marks)

33. (a) Which of the following has the highest osmotic pressure: 0.1M sucrose, 0.1M acetic acid, 0.1M KCl and 0.1M Na_2SO_4 all in water? Why?

(b) Why do you get abnormal molecular masses of the substances by using colligative properties of the solution.

(c) Discuss in detail about the determination of molecular mass of a non volatile compound from elevation in boiling point and depression in freezing point

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples.

(b) Define critical solution temperature. Explain systems having upper and lower CST using examples

(c) Explain the applications of UV spectroscopy

35. (a) Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.

(b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR spectrum of ethanol molecule.

UNIVERSITY OF KERALA

Complementary Chemistry for Botany Majors

SEMESTER	**IV**
COURSE TITLE	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1431.3**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the principle and applications of chromatography and electrophoresis	U
2	Classify amino acids, proteins, carbohydrates and vitamins. Identify and distinguish the structure of amino acids, peptides, proteins and nucleic acids.	U
3	Summarise the concept of optical isomerism.	U and A
4.	Categorise crude drugs and explain the method of evaluating crude drugs.	U
5.	Draw the structure of aminoacids, carbohydrates, simple optical isomers	R
6.	Explain the preparation and reactions of amino acids and carbohydrates	U
7.	Discuss the extraction process and general properties of natural products -oils, fats, terpenes and alkaloids.	U

*R-Remember, U-Understand, A-Apply

MODULE I - CHROMATOGRAPHY 9 Hrs

Outline study of adsorption and partition chromatography-

Principle and applications of paper, thin layer, ion exchange and gas chromatography

Principle, instrumentation and applications of HPLC

Rf and Rt value of various chromatographic techniques

Electrophoresis – Principle and application of Zone and Capillary electrophoresis

MODULE II - STEROCHEMISTRY 9 Hrs

Optical Isomerism : Chirality and elements of symmetry; DL notation and Enantiomers

Optical isomerism in glyceraldehydes, lactic acid and tartaric acid

Diastereoisomers and mesocompounds

Cahn-Ingold-Prelog rules – R-S notations for optical isomers with one and two asymmetric carbon atoms

Racemic mixture, resolution and methods of resolution

MODULE III - AMINO ACIDS AND PROTEINS 9 Hrs

Amino acids: - Classification, structure and stereochemistry of amino acids
Essential and non essential amino acids, zwitter ion, isoelectric point

General methods of preparation and reactions of amino acids

Peptides: structure and synthesis-Carbobenzoxy and Sheehan method

Proteins: - Structure of proteins, denaturation and colour reactions

Nucleic acids: - Classification and structure of DNA and RNA- Replication of DNA, Genetic Codes-Translation- Transcription

MODULE IV - OILS, FATS, ALKALOIDS, VITAMINS AND TERPENES 9 Hrs

Oils and Fats: Occurrence and extraction-Analysis of oils and fats-
saponification value, iodine value and acid value

Alkaloids: - Extraction and structural elucidation of conine and importance of
quinine, morphine and codeine

Terpenes: Classification- Isoprene and special isoprene rule-Isolation of essential oils-

citral and geraniol (No structural elucidation)

Vitamins: - Classification and structure, functions and deficiency diseases (structures of vitamin A, B1 and C but no structural elucidation).

MODULE V - CARBOHYDRATES 9 Hrs

Classification- Configuration of glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose

Preparation and properties of glucose and fructose (oxidation, reduction and reaction with phenylhydrazine only)

Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected)

Mutarotation and epimerization- Conversion of glucose into fructose and viceversa

Structure of starch and cellulose (structure elucidation not expected)

MODULE VI - PHYTOCHEMICALS AND CRUDE DRUGS 9 Hrs

Pharmacognacy – Scope and importance, scheme for pharmacognotic studies of crude drugs

Phytochemicals. Crude drugs: Morphological, pharmacological and chemical classification

Collection and processing of crude drugs – collection and harvesting, drying, garbling, packing

Processing of drugs: Method of preparation – decotion, maceration and infusion

Methods of drug evaluation: Moisture content, volatile content, solubility, optical rotation, ash values and extracting, spectroscopic analysis, chromatographic method and foreign organic matter (Mention only)

Phytoconstituents of therapeutic values: Carbohydrates, glycosides (saponin glycosides and cardiac glycosides), alkaloids (quinoline, isoquinoline, indole alkaloids and steroidal alkaloids) volatiles oils and phenols (Mention its sources, important compounds in each class and therapeutic importance)

Text Books / References

1. Organic Chemistry of Natural Products, Chatwal, Gurdeep.R, Himalaya Publications
2. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd

3. Chromatography, .B.K .Sharma, GOEL Publishing house, Meerut
4. Pharmacognosy, A.Roseline, MJP publishers, 2011.
5. A textbook of Organic Chemisty, K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, Vikas Publishing House (Pvt) Ltd., New Delhi.
6. Modern Organic Chemistry, S.C.Sharma and M.K.Jain, Vishal Publishing Company, New Delhi.
7. Stereochemistry of Organic Compounds: Principles and Applications, D.Nasipuri, New Age International Publizhers, New Delhi.

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Botany Majors

Course Code CH1431.3 Credit 3

ORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What is meant by Rf value?
2. Define Racemic mixture.
3. Represent the configurations of D and L glyceraldehyde.
4. Give two examples of essential amino acids.
5. Describe a colour test for proteins.
6. Define Iodine value.
7. Name a phytochemical.
8. State Special isoprenerule?
9. Write an example for volatile oil .
10. Give the deficiency disease of Vitamin C.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Give the principle of adsorption chromatography.
12. What is meant by denaturation of proteins.
13. Discuss the importance of Morphine.
14. Which of the following are optically active ? Why?

    (i) 2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane
15. Give four differences between enantiomers and diastereoisomers.
16. Write a note on the different types of RNA and its functions.
17. How are alkaloids extracted from natural sources?
18. Give the classification of Vitamins.
19. What happens when glucose is treated with Br_2 water?
20. Define moisture content and extraction value.
21. Name four anticancer compounds from plants.
22. Explain saponification.

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Discuss the optical isomerism of tartaric acid.
24. Write a note on DNA replication.
25. Give the synthesis of Tryptophan.
26. Comment on zwitter ion and isoelectric point.
27. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
28. Give a brief account on Thin Layer Chromatography.
29. Write a note on the methods of isolation of terpenoids.
30. Describe the structure of starch and cellulose.
31. Mention the source and therapeutic value of the alkaloid phytoconstituent.

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. (a)Explain Ion exchange Chromatography.

    (b)Elucidate the structure of Coniine.

(c)Describe the structure of DNA.

33. (a)Discuss briefly the structure of Protein.

(b)Explain Sheehan's method of peptide synthesis.

(c)What are crude drugs? Discuss its classification

34. (a)What is resolution? Explain any three methods of resolution.

(b)What are meso compounds? Are they optical active? Explain with a suitable example.

(c)Discuss the isolation, structure and uses of geraniol.

35. (a) Diffrenciate mutarotation and epimerization

(b) Define Oils and fats and discuss the different methods of extraction.

(c)Discuss on the pyranoside structure of glucose and furanoside structure of fructose.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF BOTANY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR BOTANY**
COURSE CODE	**CH 1432.3**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
1	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
2	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
3	Develop skill in observation, prediction and interpretation of reactions	U,A
4	Prepare organic compounds, Purify and recrystallise	U,A
5	Develop skill in weight calculation for preparing standard solutions	E,A
6	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
7	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

Course Code CH1432 .3 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- cresol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters

COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

This Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

COMPLEMENTARY COURSES -4

TOTAL CREDITS – 14

ONE SEMESTER =18 WEEKS

Semester	Hours per week		Number of Credits	Course Code	Instructional Hours
	Theory	Lab			
1	2	2	2	CH1131 .4	2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .4	2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .4	3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .4 CH1432 .4	3×18 =54 2×18 = 36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.4**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Differentiate particle nature and wave nature of matter	U
2	Associate wave concept with microscopic matter	A
3	Understand the relevance of periodic classification of elements	U
4	Descibe the various tupes of chemical bonds	R
5	Apply the VSEPR theory to explain the geometry of molecules	E,A
6	Comprehend different segments of titrations	U

7	Apply the principles of colorimetry to estimate ions and elements	A
8	Recognize the factors affecting environment and solutions for it	E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –ATOMIC STRUCTURE 9 Hrs

Atomic spectrum of Hydrogen – different series, Rydberg equation

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.

Orbital wise electron configuration, energy sequence rule – Pauli's Principle, Hund's rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING 9 Hrs

Energetics of bond formation –Born Haber cycle

Hybridisation and structure of molecules – sp, sp^2' sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3

hybridisation with examples- Explanation of bond angle in water and ammonia

VSEPR theory with regular and irregular geometry

Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility

Partial covalent character of the ionic bond- Fajan's rules-

A brief review of molecular orbital approach-

LCAO method – bond order, bond distance and stability of O_2, O_2^{2+}, O_2^{2-}, NO, NO^+

MODULE III: ANALYTICAL PRINCIPLES **9 Hrs**

Principles of volumetric analysis- primary standard - standard solutions- normality and molarity - theory of acid - base titrations, permanganometric and dichrometric titrations, iodometric and complexometric titrations-

Theory of acid – base and redox indicators-

Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate

MODULE IV – ENVIRONMENTAL CHEMISTRY **(9 Hrs)**

Nature of environmental threats and role of chemistry-

Green house effect, ozone layer and its depletion-

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis

Dissolved oxygen-BOD, COD

Text Books / References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, “Text book of Qualitative Analysis”
6. A. I. Vogel, “Text book of Quantitative Inorganic Analysis”.
7. S. K. Banerji, “Environmental Chemistry”.
8. A. K. De “Environmental Chemistry - An introduction”
9. B. K. Sharma “Air Pollution”.
10. V. K. Ahluwalia “Environmental Chemistry”
11. G.W. van Loon and S. J. Duffy “Environmental Chemistry: A global perspective”

I Semester B.Sc Degree Examination Model question paper
Complementary course for Zoology Majors
Course Code CH1131.4 Credit 2
THEORETICALCHEMISTRY
(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is Bohr Bury's rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr's theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?

16. Mention the rules for adding electrons to molecular orbitals?

17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?

19. Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20. Which are the green house gases? Mention their sources.

21. What is reverse osmosis? How it is useful in the purification of waste water?

22. What are chief factors responsible for water pollution?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol-1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. (a) Discuss Bohr Theory, highlighting its merits and demerits.

    (b)What are quantum numbers? Give its significance.

(c) Explain various rules regarding electronic configuration.

33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

(b) Explain the theory of redox indicators.

(c) Explain Beer's Law, Lambert's Law and Beer – Lambert Law.

34. (a) Write a note on Hydrogen bonding and its consequences.

(b) How electronic configuration of molecules related to molecular behavior? Explain.

(c) Explain Fajan's Rule.

35. (a) Discuss the formation and importance of ozone layer.

(b) What is meant by pollution and pollutants? Explain the classification of air pollutants.

(c) What are the sources of important air pollutants?

UNIVERSITY OF KERALA

SYLLABUS FOR COMPLEMNTARY CHEMISTRY OF FOR ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	II
COURSE	2
COURSE NAME	INORGANIC CHEMISTRY
COURSE CODE	CH1231.4
CREDIT	2
L-T-P	2-0-2

TOTAL HOURS	36

CO No.	COURSE OUTCOME *Upon completion of this course, the students,:*	Cognitive Level
1	Understand the biological and environmental aspects of organic compounds	U
2	Comprehend the meaning of stability of nucleus	R
3	Summarise the applications of radioactivity	U
4	Predict the properties of transition metal complexes	A
5	Understand the applications of metal complexes	U
6	Learn to appreciate biological processes like photosynthesis, respiration etc	E
7	Discuss the biochemistry of trace elements	U,E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I :ORGANOMETALLICS **9Hrs**

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications

Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses

Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture

Environmental aspects of Organometallic compounds

MODULE II NUCLEAR CHEMISTRY **9Hrs**

Natural radioactivity, modes of decay, Geiger–Nuttal rule-

Artificial transmutation and artificial radioactivity-

Nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion-

Applications of radioactivity- ^{14}C dating, rock dating, neutron activation analysis and isotope as tracers

MODULE III - COORDINATION CHEMISTRY 9Hrs

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism

Valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes

Application of metal complexes in qualitative and quantitative analysis

MODULE IV – BIO INORGANIC COMPOUNDS 9Hrs

Metalloporphyrins – cytochromes –

Chlorophyll - photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of O_2 – CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

References

6. Co-ordination Chemistry – Bosolo and Johns
7. Chemistry of Organometallics – Rochoco.
8. Concise Inorganic Chemistry – J.D. Lee

9. Puri, Sharma and Kalia "Inorganic Chemistry"
10. Modern Inorganic Chemistry A.D. Madan

UNIVERSITY OF KERALA

II Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1231.4 Credit 2

INORGANIC CHEMISTRY

(2020 Admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Give the structure of Zeisel's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of $K_3[Co(NO_2)_4Cl_2]$
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?

10. Give an example of anaerobic respiration.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. What are trace elements?
22. What is the role of chlorophil in photosynthesis?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Write a note on organotin compounds.

24. Write a brief note on the applications of organometallic compounds in agriculture and horticulture.

25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?

26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss briefly the biochemistry of iron toxicity and nutrition.

31. Metal ions play a variety of roles in biological systems. Explain.

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)

(b) What are Frankland reagents? Give its significance. (5 marks)

(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)

(b) Give the principle of neutron activation analysis. (5 marks)

(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5 marks)

(c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

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SYLLABUS OF COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1331.4**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Classify carbohydrates, aminoacids, proteins, nucleic acids, lipids, polymers and drugs.	**U**
2	Summarize optical, geometrical and conformational isomerism Draw the structure of simple carbohydrates	U
3	Discuss the structure of proteins	U
4	Explain the synthesis of amino acids, peptide,drugs	U

5	Predict absolute configuration of stereo centers	A

R-Remember, U-Understand, A-Apply

MODULE I – STEREOCHEMISTRY 9 Hrs

Optical isomerism – chirality, Enantiomers, racemisation- Optical isomerism of lactic and tartaric acid- Resolution and methods of resolution

Relative and absolute configuration, Enantiomeric excess, asymmetric synthesis

Geometrical isomerism, geometrical isomerism in maleic and fumaric acid, E and Z nomenclature-Aldoximes and ketoximes

Conformational isomerism-Rotation about carbon – carbon single bond, conformation of ethane, butane cyclohexane, axial and equatorial bonds

MODULE II – CARBOHYDRATES 9Hrs

Classification. Configuration- glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose

Preparation and properties of glucose and fructose

Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected)

Mutarotation and epimerization

Properties and structure of sucrose. (structure elucidation not expected)

Structure of starch and cellulose (Elementary idea only)

MODULE III – AMINO ACID AND PROTEINS 9 Hrs

Classification and properties of aminoacids

Synthesis of glycine, alanine and tryptophan

Polypeptides and proteins, peptide linkage, peptide synthesis

Primary,secondary, tertiary and quarternary structure of proteins

Test for proteins

Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory- Co-enzymes

MODULE IV– NUCLEIC ACIDS AND LIPIDS 9 Hrs

RNA, DNA – their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids

Replication of DNA- Transcription and Translation - Genetic code

Lipids – Classification oils, fats and waxes, iodine value and saponification value, properties of oils and fats – phospholipids

MODULE V – POLYMERS **9 Hrs**

Classification with example – natural and synthetic polymers – condensation and addition polymerization- Elastic fibres, thermoplastics and thermosetting plastics

Terpenes – classification, isoprene rule, essential oils, elementary study of citral and geraniol (structure elucidation not required)

Rubber - structure – Vulcanisation of rubber – synthetic rubber – neoprene, butyl rubber, Buna S, Buna N

MODULE VI – DRUGS **9 hours**

Classification of drugs- analgesic, antipyretic, antibiotic, hypnotics, sulphadrugs, antacids, antimalarials

Mode of action of sulpha drugs

Synthesis of aspirin, sulphaguanidine, Paracetamol

Drugs of plant origin- anticancer compounds from plants

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1331.4 Credit 3

ORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1) Give an example of a Sulpha drug.
2) Write the structure of aspirin.
3) Draw the most stable conformer of cyclohexane.
4) Write the epimer of D-Glucose.
5) What are polysaccharides?
6) What are zwitter ions?
7) Relationship between the base sequence in DNA and the amino acid sequence in   protein is known as ……………..
8) Write the structure of tryptophan.
9) Name the monomer of natural rubber.
10) Name the purine bases present in DNA.

SECTION B

*(Answer **any 8** question. Each question carries 2 Marks)*

11) What is atropisomerism?
12) How will you prepare sulfaguanidine?
13) What is asymmetric synthesis? Illustrate.
14) Explain racemisation.
15) What is inversion of cane sugar?
16) What are copolymers?
17) Explain saponification value.
18) What is zwitter ion?
19) Draw the structure of D-Arabinose, D-Ribose, L-Glyceraldehyde and L-Erythrose.
20) What are phospholipids?
21) Name the products of hydrolysis of nucleoproteins.
22) What do you understand by the term Buna-N?

SECTION C

*(Answer **any 6** question. Each question carries 4 Marks)*

23) Write a note on the mode of action of sulpha drugs.
24) Explain the E & Z notation of geometrical isomers with examples.
25) Explain mutarotation and epimerization.

26) Explain the following denaturation and colour reactions of protein.

27) Explain isoprene and special isoprene rule

28) What are lipids? Give examples. Enumerate their functions.

29) Describe the synthesis of Paracetamol.

30) What are enzymes? Give their general characteristics.

31) What is iodine value? Write its importance.

SECTION D

*(Answer **any 2**question. Each question carries 15 Marks)*

32) (a) What are drugs? How are they classified

(b)Explain enzyme catalysis using Michaelis – Menton theory

(c) Assign the R and S configuration of D- & L- Lactic acid. (6+4+5

33) (a) What is resolution? Explain any two methods.

(b) Explain the geometrical isomerism in maleic and fumaric acid.

(c) Discuss the ring structure of glucose. (5+5+5)

34) (a) Explain two methods of synthesizing peptides.

(b) Discuss primary and secondary structure of proteins.

(c) Comment on the structure of starch and cellulose. (5+5+5)

35) (a) Describe the classification of oils.

(b) Discuss the structure of DNA.

(c) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine (iii) CH_3OH and dry Conc.HCl.

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SYLLABUS OF COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

SEMESTER	**IV**
COURSE	**4**

COURSE NAME	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1431.4**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** ***Upon completion of this course, the students,***	**Cognitive Level**
1	Classify reactions on the basis of order and molecularity	U
2	Discuss different concepts of acids and bases	R,U
3	Understand different techniques used for the study of colloids	U
4	Calculate rate and order of reactions	E,A
5	Review the principles underlying the working of sophisticated instruments	U

*R-Remember, U-Understand, A-Apply

MODULE I - CHEMICAL KINETICS **9 Hrs**

Rates of reactions, various factors influencing rates of reactions

Order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory

Catalysis- Different types of catalysis- intermediate compound formation theory and adsorption theory

MODULE II–IONIC EQUILIBRIUM 9 Hrs

Arrhenius, Lowry- Bronsted concepts of Acids and Bases- Kw & pH

pH of strong acid and weak acid Ka & Kb,

Mechanism of Buffer action- Henderson equation –pH of Buffer

Hydrolysis of salt – degree of hydrolysis and hydrolytic constant

MODULE III- COLLOIDS 9 Hrs

Colloidal state- Types of colloids

Preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids

Ultra microscope, Electrical double layer and zeta potential

Coagulation of colloids, Hardy-Schulz rule

Micelles and critical micelle concentration, sedimentation

Application of colloids – Cottrell precipitator, purification of water and delta formation

MODULE IV - SPECTROSCOPY 9 Hrs

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation-

Concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects.

UV-Visible spectra of enes - Calculation of λmax

Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH

Principle of MRI

MODULE V- INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS 9 Hrs

Principle – instrumentation and applications of Atomic absorption spectroscopy- flame emission spectroscopy

Thermal methods - thermogravimetry (TG) - Differential thermal analysis (DTA)

Gas Chromatography- HPLC

Introduction to zone electrophoresis and capillary electrophoresis

MODULE VI SOLUTIONS 9 Hrs

Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures

Raoult's law, vapour pressure- composition and temperature-composition curves, fractional distillation, deviation from Raoult's law

Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST, Theory of steam distillation

Text Books /References

1. Organic Chemistry of Natural Products, Chatwal,Gurdeep.R, Himalaya Publications
2. Principles of physical chemistry, Puri Shrama Pathania, Vishal
3. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd
4. Elementary organic spectroscopy, Y.R Sharma, S chand & Company
5. Principles of Physical Chemistry, B.R.Puri, R.L.Sharma & Pathania, Vishal Publishing
6. Essentials of Physical Chemistry, B.S. Bahl., G.D. Tuli & Arun Bahl , S.Chand & Co., New Delhi.
7. Simplified Course in Physical Chemistry, R.L. Madan, G.D. Tuli , S.Chand & Co.
8. Chromatography, B.K .Sharma, GOEL Publishing house, Meerut

UNIVERSITY OF KERALA

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1431.4 Credit 3

PHYSICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define P^H.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift
7. Explain chromophore with an example.
8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Write a short note on zone electrophoresis

SECTION B

*(Answer **any 8** question. Each question carries 2 Marks)*

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constant of a chemical reaction on the absolute temperature and explain the terms involved.
13. Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?
15. What is critical micelle concentration? Discuss the structure of micelles in polar and nonpolar media
16. Tetra MethyL Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Explain the working of Hollow Cathod Lamp
19. What is the difference between GC and HPLC?
20. Explain the terms Degree of hydrolysis and hydrolysis constant.
21. What are the conditions at which the solutions deviate from ideal behaviour?
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

SECTION C

*(Answer **any 6** question. Each question carries 4 Marks)*

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31 \times 10^{-3}\ s^{-1}$. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = 1.85×10^{-5}.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$
30. Briefly explain TGA taking suitable example
31. Explain the principle of Fractional Distillation

SECTION – D

(*Answer* ***any 2*** *question. Each question carries 15 marks*)

32. (a)Differentiate between Molecularity and order of a reaction with examples

(b) Discuss the Kinetic, optical and electrical properties of colloids

(c) Explain the protective action of colloids

33. (a) Discuss the principle and applications of AAS

(b) Distinguish between AAS and FES

(c) Explain the applications of TGA and DTA

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples.

(b) Define critical solution temperature. Explain systems having upper and lower CST using examples

(c) Explain the applications of UV spectroscopy

35. (a) Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.

(b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR spectrum of ethanol molecule.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE TITLE	**COURSE V : LAB COURSE FOR ZOOLOGY**
COURSE CODE	**CH 1432.4**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR ZOOLOGY MAJORS)

Course Code CH1432 .3 Credit 2

I. QUALITATIVE ANALYSIS

A. Reactions of organic compound
B. (aromatic – aliphatic,
C. saturated – unsaturated,
D. detection of elements
E. Detection of functional group
glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters.

II. Systematic analysis with a view to identify the Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

III. ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

IV. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

V. GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

VI.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in semesters I-IV

COMPLEMENTARY CHEMISTRY FOR HOMESCIENCE MAJORS

DISRIBUTION OF HOURS AND CREDITS

Semester	Hours/Week	No. of	Course Code	Instructional

	Thoery(L)	Lab(P)	Credits		Hours
I	2		2	CH1131.5	2x18=36
		2	-		2x18=36
II	2		2	CH1231.5	2x18=36
		2	-		2x18=36
III	3		3	CH1331.5	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.5	3x18=54
		2	4	CH1432.1	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**INORGANIC AND ANALYTICAL CHEMISTRY**
COURSE CODE	**CH1131 .5**
Credit	**2**
TOTAL HOURS	**36**
L-T-P	**2-0-2**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the Bohr atom model and represent electronic configuration of elements	U	
2	Discuss the theory of volumetric analysis	U	

3	Explain radioactivity and its applications	A	
4.	Applies the importance of radioactivity in terms of energy and environment conservation.	A	
5.	Classify organometallics	U	
6.	Identify the importance and impact of organometallics.	U	

Re-Remember, Un-understand, Ap-apply

MODULE I –ATOMIC STRUCTURE (9 Hrs)

Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theory-postulates –statement of Bohr energy equation –derivation of spectral frequency from Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four quantum numbers and their significance- Orbital wise electron configuration, energy sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

MODULE II- ANALYTICAL PRINCIPLES (9 Hrs)

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems, theory of acid base titrations, permanganometric and dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are to be worked out) .

MODULE III- RADIOACTIVITY AND NUCLEAR CHEMISTRY (9Hrs)

Radioactive decay series, Radioactive equilibrium, Average life, Half life detection of radio activity-Geiger Muller Counter, Wilson cloud chamber, Units of radioactivity-Curie and Rutherford, Units of radiations. Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation and radioactivity, mass defect, binding energy, Applications of radio activity- in medicine, agriculture and archeology. Biological effects of radiation, pathological and genetic damage.

MODULE IV- ORGANOMETALLICS AND BIOMOLECULES (9 Hrs)

Organometallic compounds –Definition and classification, Biological , medicinal and environmental aspects organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin. Structure and Physiological functions.

References

1. Concise Inorganic Chemistry J. D. Lee

2. Inorganic Chemistry	Puri and Sharma
3. Chemistry of Organometallics	Rochow
4. Organic Chemistry Vol 2	I.L. Finar
5. Chemistry of natural products Vol. 1	Gurdeep Chatwal
6 The Text Book of Organic Chemistry	P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry	R D Madan

II Semester Complementary Chemistry Model Question paper

(for Homescience Majors)

Course Code-CH1131 .5 Credit 2

INORGANIC AND ANALYTICAL CHEMISTRY

Time : Three Hours **Total marks : 80**

Section – A

Answer all questions. Each question carries 1 mark

1. Give the relationship between wavelength, frequency and velocity of electromagnetic radiation?
2. What is the Rydberg equation for calculating the wave number of radiation?
3. Give Schrodinger equation which describes the behaviour of electron in an atom?
4. Indicator used for the titration between strong base and weak acid?
5. Give two examples of primary standard?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Give two examples of Organomercuric comounds in medicine ?
10. What are organometallic comounds? (1×10=10 marks)

Section – B

Answer any eight. Each question carries 2 marks

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. 50 ml of 0.25N NaOH required 40 ml aqueous HCl solution, calculate the normality of HCl solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes? (8 x 2 = 16 marks)

Section – C

Answer any six. Each question carries 4 marks

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?
25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine? (6 x 2 = 24 marks)

Section – D

Answer any two. Each question carries 15 marks

32. a) Derive the Bohr frequency equation?(5marks)
    c) Discuss the atomic spectra of hydrogen atom.(5 marks)

    b) Explain quantum numbers. (5 marks)

33. a)Write notes on Acid base indicators? (5 marks)
    b)Explain the Permanganometric titration? (5mark)

    c) Calculate the weight required to prepare the following solutions (i) N/5 aqueous solution of sodium carbonate in 250ml (ii) M/5 aqueous solution of sodium carbonate in 100 ml.

34. a)What are the applications of radioactivity in medicine and agriculture? (6marks)
    b) Write notes on radioactive decay series? (5mark)

    c) A living plant acquires definite fraction of ^{14}C nuclei in its carbon content. If a freshly cut piece of wood gives 16.1 counts per minute per gram and an old wooden bowl gives 9.6 counts per minute per gram of carbon, calculate the age of the wooden bowl. The half life of ^{14}C is 5770 years.

35. a) Write in detail the classification of organometallic compounds with examples? (5 marks)

    b) Explain the biological aspects of myoglobin? (5marks)

    c) Discuss the structure of Haemoglobin. (5 marks) (2 x 15 = 30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1231 .5**
CREDIT	**2**
TOTAL HOURS	**36**
L-T-P	**2-0-2**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level
1	Identify and represent the structure of simple carbohydrates	U
2	Assign role of vitamins and hormones for different biological activities	U

3	Identify the deficiency diseases caused by vitamins and hormones	A
4.	Classify carbohydrates, vitamins, amino acids and enzymes.	A
5.	Discuss the structure of proteins.	U

Re-Remember, Un-understand, Ap-apply.

MODULE I: CARBOHYDRATES (9hrs)

Classification, configuration of glyceraldehydes, erythrose, threose, ribose,2- deoxy ribose, arabinose, glucose, fructose and mannose. Reactions of glucose and fructose. Pyranoside structures of glucose and fructose Furanoside structure of fructose (structure elucidation not expected), muta rotation, epimerization, conversion of glucose into fructose and vice versa.

MODULE II VITAMINS (9hrs)

Classification, source, physiological function and deficiency diseases caused by Vitamin A1(retinol), A2(axerophthol), Vitamin B-B1 (thiamine), B2(riboflavin and folic acid), B5(niacin), B6(Pyridoxine), B12 (Cyano cobalamine) Vitamin C (ascorbic acid),–Vitamin,D2 (ergocalciferol), Vitamin E (Tochopherols), Vitamin H(biotin) and Vitamin K.

MODULE III :AMINOACIDS AND PROTEINS (9hrs)

Classification. synthesis of glycine, alanine, phenyl alanine and aspartic acid, zwitter ion, isoelectric point,, reactions of aminoacids, peptide linkage, peptide synthesis, polypeptides, primary, secondary, tertiary and quarternary structure of proteins, classification, biological importance and tests for proteins.

MODULE IV: ENZYMES AND HORMONES (9hrs)

Enzymes- Characteristics, classification, factors influencing enzyme action, mechanism of enzyme action, Michaelis –Menton theory, enzyme inhibitors.

Hormones- Introduction, functions and abnormalities due to oxytocin, thyroxin,

glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin

Text Books/References

1. Fundamentals of Biochemistry A.C. Deb
2. Biochemistry Rastogi

3. Chemistry of Organometallics — Rochow
4. Organic Chemistry Vol 2 — I.L. Finar
5. Chemistry of natural products Vol. 1 — Gurdeep Chatwal
6. The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry — R D Madan

Model Question paper

II Semester Complementary Chemistry Model Question Paper

(For Home Science Majors)

Course Code CH1231 .5 Credit 2

2020 Admission onwards

ORGANIC CHEMISTRY

Time : Three Hours **Total marks : 80**

Section – A

Answer all. Each question carries 1 mark.

1. Write the name of a neutral aminoacid?
2. Give the name of an essential aminoacid?
3. What is peptide linkage?
4. Give the name of a monosaccharide?
5. Write one reaction of glucose?
6. What is a carbohydrates?
7. Give the other name of oxytocin?
8. Give the name of two enzymes?
9. Give two functions of enzymes?
10. Which vitamin is called anti haemorrhagic vitamin? (10 x 1 = 10 marks)

Section – B

Answer any eight. Each question carries 2 marks

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?

18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation? (8 x 2 = 16 marks)

Section C

Answer any six. Each question carries 4 marks

23. What is the reaction of amino acid with nitrous acid?
24. Explain the isoelectric point of an aminoacid?
25. Give the method of synthesis of glycine?
26. What are the factors affecting enzyme action?
27. Give the functions and deficiency diseases of vitaminC ?
28. What is Michaeli's Menton theory of enzyme action?
29. Write a note on Furanoside structure of fructose?
30. How will you convert glucose into fructose?
31. Write configuration of glyceraldehydes and erythrose? (6 x 4 = 24 marks)

Section – D

Answer any two. Each question carries 15 marks

32. a) Explain the primary, secondary and tertiary structure of protein. (10 marks)
    b) Describe any one method of synthesizing aspartic acid (5 marks)

33. a) What are vitamins? How are they classified? (3marks)
    b) Discuss the physiological functions of vitamin A1, B2, B12, C and D (8 marks)

    c) Listout the different sources of vitamins (4 marks)

34. a) Discuss the functions of the following hormones (i) thyroxin, (ii) glutathione (iii)

    progesterone (6 marks)

    b) List out and explain the abnormalities due the deficiency of the following hormones

    (i) estrogens (ii) cortisone (iii) adrenalin. (6 marks)

    c) Discuss on enzyme inhibitors. (3 marks)

35. Discuss:

    (a) classification of carbohydrates. (3 marks)

    (b) pyranose structure of glucose. (5 marks)

    (c) Reaction of glucose with (i) Bromine water (ii) Tollen's reagent (iii) phenyl

    hydrazine. (6 marks)

(2 x 15 = 30marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**ORGANIC CHEMISTRY -II**
COURSE CODE	**CH1231 .5**
CREDIT	**3**
TOTAL HOURS	**54**
L-T-P	**3-0-2**

Semester-III

Complementary Course No. - 3

Course Code-CH1331 .5 – Organic Chemistry- II
Total: 54 hours

Credit-3 **L-T-P 3-0-2**

Course Outcomes

CO No.	**Expected Course Outcomes** Upon completion of this course, the students	Cognitive Level	PSO No.
1	**Understand the chemistry of simple heterocyclics**	**Un**	
2	**Give an insight about the role of chemistry in the world of dyes**	**Un**	
3	**Develop an understanding about the phytochemicals like alkaloids and terpenes**	**Ap**	
4.	**Appreciate the achievements of polymer molecule in the field of medicine & food packaging**	**Ap**	

5.	**Classify drugs and polymers**	**Un**	

Re-Remember, Un-understand, Ap-apply.

MODULE 1:HETEROCYCLICS (9hrs)

Introduction, Classification and nomenclature. Preparation, physical properties, acidic and basic character, aromatic character, addition , substitution, oxidation and resonance structures of pyrrole, furan, thiophene and pyridine. Purine and pyrimidine bases.

Module 2: Terpenes (9hrs)

Introduction, isolation, occurrence, isoprene rule, classification.

Physical and chemical properties and uses of citral, geraniol, menthol and camphor.

An elementary idea of the structure of natural rubber, synthetic rubber, Buna-N, Buna-S, Neoprene and Thiokol.

Module 3: Alkaloids (9hrs)

Occurrence, classification, general methods of isolation. General methods of determining structure: Functional nature of oxygen containing groups – identification of hydroxyl group, carboxyl group, oxo group, ester group, methoxyl group, methylenedioxyl group. Functional nature of nitrogen containing groups – identification of primary, secondary and tertiary amino groups, Hoffmann exhaustive methylation . Structure and physiological actions of coniine, nicotine, quinine, morphine and codeine (structure elucidation is not expected).

Module 4: Medicinal Chemistry (9hrs)

Chemo therapy- Drugs-Classification based on application. Elementary study of analgesics,

antipyretics, antibiotics, antimalarials. sulphadrugs, mode of action of sulphadrugs.

Synthesis of aspirin and paracetamol

Module 5: Polymers (9hrs)

Natural and synthetic polymers, preparation and uses of vinyl polymers-PE, PVC, PVA, PS, PVF, PMMA, PTFE, Synthetic fibres-Nylon, Nylon 66,Terylene, Poly ethyl teraphthalate, polymers in medicine, surgery and food package.

Module 6: Colour and constitution, Dyes (9hrs)

Colours, complimentary colours, Theories of colour and constitution - chromophore-auxochrome theory, modern theory of colours. Classification of dyes on the basis of structure and application. Preparation and uses of para red and methyl orange, phenolphthalein and fluorescein , Alizarin, malachite green.

REFERENCES:

1.Essentials of Physical Chemistry	B S Bahl GD Thuli Arun Bahl
2. Analytical chemistry	S M Khopkar
3. Chemistry of natural products Vol. 1	Gurdeep Chatwal
4. Text Book of Organic Chemistry	P.L Soni, H.M. Chowla
5. Organic ChemistryVol 1 & 2	I.L. Finar
6. Text Book of Organic Chemistry	Arun Bahl & B S Bahl
7. Polymer Chemistry	B.K Sharma
8. Inorganic Polymer Chemistry	G S Misra
9. Inorganic Chemistry	Puri and Sharma

III Semester Complementary Chemistry Model Question paper

(for Homescience majors)

Course - III , Course Code-CH1331 .5

ORGANIC CHEMISTRY - II

Time : Three Hours **Total marks : 80**

Section – A

Answer all questions. Each question carries1 mark

1. Give two examples for nitrogen containg heterocyclics.

2. Draw the structure of furan and thiophene.
3. An alkaloid present in hemlock herb.
6. Give an example for a drug used as an antipyretics.
7. What are antimalarials?
8. What are complementary colours?
9. Explain chromophore with an example.
10. Draw the structure of citral.
11. How many isoprene units are in sesquiterpenes ?
12. Write any two uses of PVC. (1×10=10 marks)

Section – B

Answer any eight. Each question carries 2 marks

13. Explain any one method of preparation of furan.
14. Write the names of purine bases present in nucleic acids.
15. What are drugs?
16. Name two antibiotics.
17. How will you prepare phenolphthalein?
18. What is mordant dye? Give an example
19. What is Buna rubber?
20. Write the reaction of citral with silver oxide.
21. Draw the structure of morphine.
22. How is the functional nature of OH analysed in alkaloids ?
23. What is Bakelite?
24. Give the structure of Nylon 66. (2×8 =16 marks)

Section – C

Answer any six. Each question carries 4 marks

25. Compare the basic character of pyridine and pyrrole.
26. Write a note on the classification of heterocyclics.
27. What are analgesics? Give examples. Discuss any one method to synthesis a commonly used analgesics.
28. Explain the isomerism shown by citral and geraniol.
29. What is Hoffmann exhaustive methylation?
30. Write the structure and physiological actions of nicotine.
31. Write the synthesis and uses of fluorescein.
32. How is polystyrene synthesized?
33. Write a note on polymers in medicine and surgery. (4×6=24 marks)

Section – D

Answer any two. Each question carries 15 marks

34.a) Write a short note on the aromatic character of five membered heterocyclics. (5marks)

b) What happens when thiophene is treated with (i) H_2/Pd (ii) Maleic anhydride.

Explain using chemical equation.(5 marks)

c) How pyridine is synthesized? Discuss the nuclephilic substitution reactions of

pyridine. (5 marks)

35. a) What are terpenes? Discuss isoprene and special isoprene rule. (5 marks)

b) Describe (i) the general method of isolation of terpenes (ii) classification of terpenes

(5mark)

c) Comment on the classification and isolation of alkaloids (5 marks)

36. a)What are drugs? How are they classified (5marks)

b) What are sulphadrugs? Discuss its mode of action. (5mark)

c) What is aspirin? How is it synthesized? Write its uses.(5 marks)

35. a) Discuss the classification of dyes on the basis of application. (6 marks)

b) Explain the Witt's theory of colour and constitution (6 marks)

c) Write the structure of any (i) nitro dye (ii) azo dye (iii) anthraquinone dye (3 marks)

(2 x 15 = 30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	IV
COURSE	**4**
COURSE NAME	**PHYSICAL AND SUSTAINABLE CHEMISTRY**
COURSE CODE	CH1431.5
CREDIT	3
TOTAL HOURS	54
L-T-P	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level
1	Identify the role of colloids & adsorption phenomena in everyday life	A
2	Exposed to the knowledge of Chromatographic methods useful in the analysis.	U
3	Get an overview about the chemicals used as insecticide and pestiside in agriculture field.	U
4.	Get insight to the emerging areas of chemistry - Green and Nano chemistry	U
	Become cautious of the environmental threats and take steps for sustainable development	A
5.	Impart an idea about the chemical pollutants & their detrimental effects.	U

Re-Remember, Un-understand, Ap-apply.

MODULE 1: COLLOIDS (9hrs)

Introduction, dispersed phase, dispersion medium, classification, multi molecular, macromolecular and associated colloids. Preparation - condensation and dispersion methods, purification -dialysis and ultra filtration, properties of colloidal solution- optical, kinetic and electrical properties, coagulation, Hardy-Schultz rule, protective colloid, applications of colloidal systems, emulsions, emulsifiers and cleansing action of soap.

MODULE 2: ADSORPTION AND CHROMATOGRAPHY (9hrs)

Adsorption-Adsorbent, adsorbate, desorption, types of adsorption - physical and chemical adsorption. Applications of adsorption. Chromatography- Column, TLC, paper and gas chromatography. Applications of chromatography in the separation of proteins, amino acids and dyes.

MODULE 3: GREEN & NANO CHEMISTRY (9hrs)

Green Chemistry: Chemical Pollution and its after effects, conventional waste disposal techniques & its Limitations. History of disasters like Chernobyl Disaster, Bhopal gas tragedy. Introduction to Green chemistry, twelve Principles of green chemistry.

Nano Chemistry: Introduction to nanochemistry, Nanosystems in Nature, Preparation methods for nanomaterials – top-down & bottom up approach (mention only)- sol gel synthesis, coprecipitation, colloidal precipitation, chemical vapour deposition. General introduction to nanomaterials – Fullerenes, Carbon nanotubes. Applications of nanomaterials in medical field.

MODULE-4:**INSECTICIDES AND PESTICIDES** (9hrs)

Insecticides - classification and preparation of compounds like DDT, DDE and BHC. Methoxy chlor, malathion, parathion and carbamates(mention only).

An elementary study of antiseptics, disinfectants, pesticides, rodenticides, herbicides and fungicides.

MODULE-5:ENVIRONMENTAL CHEMISTRY –I (9hrs)

Air and soil pollution-Introduction, different types of air and soil pollution, air pollutants SO_2, SO_3, NO,.NO_2 and smog. Acid rains, CO_2, CO, Green house effect, O_3, importance of ozone layer, causes and effects of ozone layer depletion. Photochemical oxidants, PAN, hydrocarbons, particulates, dust, smog, asbestos, lead, mercury, cadmium. Control of air pollution

MODULE-6:ENVIRONMENTAL CHEMISTRY – II (9hrs)

Water pollution-Factors affecting the purity of water, sewage water, Industrial waste, agricultural pollution such pesticides, fertilizers, detergents; treatment of industrial waste, water using activated charcoal, synthetic resins, reverse osmosis and electro dialysis.

References

1. An Introduction to Medicinal Chemistry — Graham L Patrick
2. Text Book of Organic Chemistry — P.L Soni, H.M. Chowla
3. Organic Chemistry Vol 1 & 2 — I.L. Finar
4. Text Book of Organic Chemistry — Arun Bahl & B S Bahl
5. Environmental Chemistry — K. Banerji
6. Environmental Chemistry - An introduction — A. K. De
7. Air Pollution — B. K. Sharma
8. Environmental Chemistry: A global perspective — G.W. vanLoon & S. J. Duffy
9. Green Chemistry Environment Friendly Alternatives — Rashmi Sanghi and M.M Srivasthava
10. NANO: The Essentials — T. Pradeep

IV Semester Complementary Chemistry Model question paper

(for Home Science Majors)

Course Code CH 1431.5 Credit 3

PHYSICAL AND SUSTAINABLE CHEMISTRY

Time: 3hr **Total mark: 80**

Section A

Answer all questions. Each question carries1 mark

1. What is meant by Brownian movement?
2. What are gels?
3. Enthalpy of adsorption is negative. True or false.
4. Name an adsorbent in paper chromatography.
5. Who is the father of Green Chemistry?
6. What is an acid rain?
7. What is a smog ?
8. What is meant by top down approach in nano synthesis?
9. What is DDT & DDE?
10. What is PAN? (1 X 10 = 10 maks)

Section B

Answer any 8 questions. Each question carries 2 marks

11. What is meant by atom economy?
12. What is sol gel synthesis?
13. What is Fullerenes?
14. Write a note on electrical double layer and zeta potential.
15. Distinguish between coagulation and peptization.
16. Write a note on Gibb's adsorption isotherm.
17. What is an aerosol? Give an example?
18. What are herbicides and fungicides?
19. What is reverse osmosis?
20. What are the uses of methoxychlor?
21. What is meant by green house effect. Name two green house gases?
22. Write about the origin of Green Chemistry. (2 x 8 = 16 marks)

Section C

Answer any 6 questions. Each question carries4 marks.

23. What are micelles? Define critical micelle concentration.
24. What is gold no? Explain protective colloid.
25. What do you understand by physical and chemical adsorption?
26. Write important applications of adsorption.
27. Comment on Bhopal tragedy
28. Discuss on nanosystems in nature.
29. Write notes on herbicides and fungicides.
30. What are the causes and effects of ozone depletion?
31. What are the limitations of conventional waste disposal methods? (6 x 4 = 24 marks)

Section D

Answer any 2 questions. Each question carries15 mark

32. (a) Briefly explain the any six principles of green chemistry.(6 marks)
    (b) Discuss the application of nanomaterials in medical field.(4 marks)

    (c) Explain sol-gel method of synthesizing nano materials. (5 marks)

33. a) Explain adsorption chromatography.(5 marks)
    b) Write a note on partition chromatography. (5 marks)

    c) Discuss the principle and procedure of TLC.(5 marks)

34. a) Explain the cleansing action of soap.
    b) Explain the Hardy-Schultz rule.

c) Discuss on (i) dialysis and (ii) ultrafiltration.

35. a) Discuss on the source of air pollution.(5 marks)
b) Describe the any two methods of water treatment. (5 marks)

c) How following compounds are prepared? (i) DDT (ii) BHC (5 marks)

(2 x 15 = 30 marks)

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE TITLE	**COURSE V : LAB COURSE FOR HOMESCIENCE**
COURSE CODE	**CH 1432.5**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry,	A

	permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR HOMESCIENCE MAJORS)

Course Code CH1432 .5 Credit 2

III. QUALITATIVE ANALYSIS

F. Reactions of organic compound
G. (aromatic – aliphatic,
H. saturated – unsaturated,
I. detection of elements
J. Detection of functional group
glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters.

IV. Systematic analysis with a view to identify the Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

III. ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

IV. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

V. GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

VI.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in semesters I-IV

SYLLABUS OF COMPLEMENTARY CHEMISTRYY COURSES

(FOR BIOCHEMISTRY MAJORS)

DISTRIBUTUIN OF HOURS

One Semester – 18Weeks

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.6	2x18=36
		2	-		2x18=36
II	2		2	CH1231.6	2x18=36
		2	-		2x18=36
III	3		3	CH1331.6	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.6	3x18=54
		2	4	CH1432.6	2x18=36

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.6**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students ,*	**Cognitive Level**
1	Understand the relevance of periodic classification of elements	U
2	Understand the significance of quantum numbers	U
3	List the various chemical bonds	R
4	Apply the VSEPR theory to explain the geometry of molecules	A
5	Appreciate the laws of thermodynamics	U

6	Understand spontaneity	U
7	Compare the stabilities of various nuclei	E
8	Appreciate the applications of radioactivity	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I–PERIODIC TABLE AND CLASSIFICATION OF ELEMENTS 9 hours

Quantum numbers and their significance- Orbit and orbitals, shape of s, p and d orbitals, Orbital wise electron configuration, energy sequence rule, Aufbau principle, Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Modern periodic law. Periodicity of elements and basis of classification of elements into s,p,d,and f block. Variation of periodic properties – atomic and ionic size, metallic and non metallic character, diagonal relationship.

MODULE II- CHEMICAL BONDING **9hours**

Energetics of bond formation, Ionic bonding, Born-Haber cycle-
Covalent bonding, hybridization and structure of molecules-sp, sp^2 ,sp^3 ,dsp^2 ,d^2sp^3 ,sp^3d^2 hybridisation with examples-
VSEPR Theory with regular and irregular geometry, explanation of bond angle in water and ammonia-
Polarity of covalent bond, its relation with electronegativity, factors influencing polarity, dipole moment, its relation to geometry-
Hydrogen bond, intra and intermolecular hydrogen bond, its consequence on BP, volatility and solubility-
Partial covalent character of ionic bond, Fajan's rule

MODULE III: THERMODYNAMICS **9hours**

Basic concepts – System – surroundings – open, closed and isolated systems
Isothermal– isochoric and isobaric process
Work – heat – energy – internal energy
Heat capacity at constant volume (Cv) and at constant pressure (Cp) – relation between Cp and Cv – First law– The second law – Enthalpy-Entropy-and Free energy
Criteria for reversible and irreversible process
Gibbs –Helmholtz equation
Concepts of spontaneous and non spontaneous processes

MODULE IV: NUCLEAR CHEMISTRY ***9 hours***
Nuclear Chemistry- stability of nucleus, n/p ratio, Radioactivity, Radioactive decay series, Radioactive equilibrium, Average life, Half life
Detection of radio activity-Geiger Muller Counter, Wilson cloud chamber
Units of radioactivity-Curie and Rutherford
Artificial transmutation and radioactivity, Units of radiations
Applications of radio activity- in archeology, medicine and agriculture.
Biological effects of radiation, pathological and genetic damage
Mass defect, binding energy, neutron activation analysis

REFERENCES

1. Concise Inorganic Chemistry -J. D. Lee
2. Inorganic Chemistry- Puri and Sharma
3. Chemistry of Organometallics- Rochow
4. Organic Chemistry Vol 2 -I.L. Finar
5. Chemistry of natural products Vol. 1-Gurdeep Chatwal
6. The Text Book of Organic Chemistry - P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry- R D Madan

First semester B.Sc Degree Examination Model question paper

Complementary course for Biochemistry Majors

CH1131.6: THEORETICALCHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. Define orbital.
2. What is the geometry of SF_6?
3. Which is bigger in size, Na or Na+? Why?
4. Which is steam volatile- o-nitro phenol or p-nitro phenol?
5. $BeCl_2$ is linear. Is it polar or non polar?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Define system.
10. What is an isochoric process? (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. How atomic size varies in a period?
14. Write the electronic configuration of Cu and Cr.
15. State Fajan's rule.
16. What is bindingenergy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. Mathematical expression for First law of thermodynamics.
20. Differentiate open and isolated systems.
21. Define entropy. What is its unit.
22. Give an example for a polar covalent bond. Explain. (8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. How the metallic and non-metallic character of elements vary down a group and along a period.
24. What is hydrogen bonding? Explain different types of hydrogen bonding with examples.
25. Discuss Born-Haber cycle.
26. Derive the relationship between Cp and Cv.
27. Write the stability of nucleus with respect to n/p ratio?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. State and explain first and second laws of thermodynamics.
31. Discuss (i) Pauli's principle (ii) Aufbau order (6 x 4 = 24 marks)

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. a) State and explain modern periodic law. (3 marks)

    b) Comment on the classification of elements into different blocks in the periodic table.(8 marks)

    c) Explain quantum numbers.(4 marks)

33. a) What is hybridisation? Discuss the shape of methane, ethylene and acetylene on the basis of hybridisation (10marks)

    b) Explain the structure of H_2O and NH_3 on the basis of VSEPR theory

34. a)What are the applications of radioactivity in medicine and agriculture? (6mark) b).Discuss on carbon dating? (5mark)

    c) ^{14}C in a living sample of wood is 15.4 counts per minute and that of an unknown sample is only 4.8 counts per minute. Find the age of the unknown sample.(Half life of ^{14}C = 5730 years)

35. a) Define the terms (i) internal energy (ii) enthalpy (iii) free energy (3 marks)

    b)What are spontaneous and non spontaneous processes. Give examples (4 marks)

    c) What is Gibbs-Helmholtz equation? How is it applied for predicting spontaneity of reactions? (8 marks) (2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL AND ANALYTICAL CHEMISTRY - I**
COURSE CODE	**CH1231.6**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students* **,**	**Cognitive Level**
1	Illustrate Le Chatelier's Principle	E
2	Compare weak and strong acids	E
3	Appreciate the effect of pH in qualitative analysis	A
4	Calculate the strength of various solutions	U,A
5	Recognize various types of titrations	A
6	Apply Hess's law	A
7	Understand the strength of bonds	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: CHEMICAL EQUILIBRIUM ***9 hours***

Reversible reactions –Equilibrium constants, Kp, Kc, and Kx and their inter relationships

Free energy change and chemical equilibrium (thermodynamic derivation not required)

Le Chatelier's principle and the influence of pressure, temperature and concentration on the following reversible reactions at equilibrium

1. Formation of NH_3 from H_2 and N_2
2. Formation of SO_3 from SO_2 and O_2
3. Dissociation of PCl_5 to PCl_3 and Cl_2

MODULE II - IONIC EQUILIBRIUM ***9 hours***

Arrhenius, Lowry- Bronsted and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant

Solubility product, Common ion effect, application in separation of ions, Example : NH_4Cl/NH_4OH in cation analysis, salting out process

MODULE III - ANALYTICAL PRINCIPLES ***9 hours***

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems on calculation of strength of solutions in normality, molarity

Theory of acid base titrations, Titration curve of strong acid -strong base, weak acid - strong base and strong acid -weak base titrations and theory of acid base indicator
Redox titrations- permanganometric and dichrometric titrations, and redox indicators

MODULE IV - THERMOCHEMISTRY ***9 hours***

Enthalpies of formation, combustion, neutralization, solution and hydration
Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature-Kirchoff's equation
Hess's law and application
Bond dissociation energies and bond energies of different types of bonds
Calculation of Bond energy, bond dissociation energy and enthalpies of reaction

REFERENCES

1. Concise Inorganic Chemistry J. D. Lee
2. Inorganic Chemistry Puri and Sharma
3. Chemistry of Organometallics Rochow
4. Organic Chemistry Vol 2 I.L. Finar
5. Chemistry of natural products Vol. 1 Gurdeep Chatwal
6. The Text Book of Organic Chemistry P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry R D Madan

Second Semester B.Sc Degree Examination Model question paper

Complementary course for Biochemistry Majors

CH1231.6: PHYSICAL AND ANALYTICAL CHEMISTRY - I

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What is reversible process?
2. Define pH.
3. What are Arrhenius acids?
4. Name an indicator used for strong acid weak base titration?
5. Give two examples primary standards?
6. What is astandard solution?
7. Define enthalpy of combustion?
8. What is Cp?
9. What is the ionic product of water?
10. Define equilibrium constant. (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. State Le-Chatlier principle.
12. Give the expression for the Ka of acetic acid.
13. Calculate the pH of 0.01M HCl.
14. What is degree of hydrolysis?
15. Define Lewis acid and base.
16. Differentiate between molarity and normality.
17. Calculate the weight of Na2CO3 required to prepare 250ml N/10 solution.
18. What is bond dissociation energy?
19. Why HCl is not used in permanganometry?
20. Define enthalpy of hydration?
21. What are the characteristics of chemical equilibrium?
22. Give a direct application of first law of thermodynamics in thermochemistry.

(8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Calculate the equilibrium constant for a reaction at 298K. (ΔG^0 = 20 Kcal)
24. Predict the effect of pressure on the dissociation of PCl_5.

25. Explain the theory of acid - base titration.
26. Comment on the Lowry-Bronsted concept.
27. Write a note on dichrometric titrations.
28. Calculate the pH of a buffer solution containing 0.2 moles of NH_4Cl and 0.1 mole of NH_4OH per liter. K_b for NH_4OH is 1.85×10^{-5}
29. Derive relation between Kh, Kw and Ka.
30. The enthalpy of formation of methane at constant pressure and at 300K is -75.83KJ. What will be the enthalpy of formation at constant volume.
31. From the following data at 298K, Calculate the bond energy of O-H bond.

    $H_2(g) \rightarrow 2\ H(g);\ \Delta H_1 = 436.08KJ$

    $O_2(g) \rightarrow 2\ O(g);\ \Delta H_2 = 495.17KJ$

    $H_2(g) + ½\ O_2(g) \rightarrow H_2O\ (g)\ ;\ \Delta H_3 = -241.84KJ$ (6 x 4 = 24 marks)

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. a) Derive relation between Kp and Kc (5 marks)

    b) Apply Le-Chatlier principle for the following equilibria

    i) $N_2 + 3\ H_2 = 2NH_3$ + heat

    ii) $2SO_2 + O_2 = 2\ SO_3$ + heat (10 marks)
33. a) What is a buffer? Explain the mechanism of buffer action (6 marks)

    b)Define the terms (i) solubility product and (ii) common ion effect(4 marks)

    c) Discuss the application of common ion effect in cation analysis (5 marks)
34. a) Write notes on acid – base indicators (6 marks)

    b)Explain ferrous iron is estimated by permanganometry (3 marks)

    c)Explain the titration curves of (i) strong acid – strong base (ii) strong acid – weak base (6 marks)
35. a) Illustate Hess's law. (6 marks)

    b)The heats of combustion of $CO_2(g)$, $H_2O(l)$ and $CH_4(g)$ are -396.2, -285.9 and -75.2KJ/mol respectively. Compute the enthalpy of combustion of methatne.(4 marks)

    c) State Kirchoff's equation. Indicate how it is used to evaluate ΔH of a reaction from heat capacity data of reactants and products. (2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE TITLE	**PHYSICAL AND ANALYTICAL CHEMISTRY - II**
COURSE CODE	**CH 1331.6**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**Expected Course Outcomes** *Upon completion of this course, the students will:*	**Cognitive Level**
1	**Understand electromagnetic spectrum and relate energy of radiations to their effect on chemical bonds**	**U,A**
2	**Appreciate different types of spectroscopy**	**U**
3	**Understand order and molecularity**	**U**
4	**Appreciate Arrhenius equation**	**A**
5	**Appreciate action of Enzymes**	**U**
6	**Understand dialysis**	**U**
7	**Comprehend the applications of colloids**	**A**
8	**Recognize the importance of Chromatography as a separation technique**	**A**
9	**Understand adsorption**	**U**

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: SPECTROSCOPY–I ***9 hours***

Regions of electromagnetic spectrum interaction radiation with matter-
Different types of energy levels in molecules, rotation, vibration and electronic levels-
Various types of molecular spectra, microwave spectroscopy, spectra of diatomic molecules, expression for rotational energy, selection rules, frequency separation, equation for frequency of vibration, expression for vibrational energy, selection rule and calculation of force constant.

MODULE II: CHEMICAL KINETICS AND ENZYME CATALYSIS ***9 hours***

Chemical kinetics, rate of reactions, various factors influencing rate,

Order, molecularity, zero, first, second, third order reactions - derivation of first order kinetics - fractional life time, units of rate constants,

Influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters

Enzyme Catalysis: Classification of enzymes.

General properties of Enzymes

Mechanism of enzyme action- Enzyme substrate interaction, Activation energy, Rate of reaction and Michaelis constant- Michaelis Mentonequation

MODULE III: COLLOIDS ***9 hours***

Colloidal state: Types of colloids, preparation of colloids-

Purification of colloids – ultra filtration and electrodialysis

Properties of colloids : Tyndal effect, , Brownian movement, electrophoresis, electro osmosis, sedimentation and streaming potential, Zeta potential

Stability of colloids, Protective colloids, Hardy- Schultz rule, gold number

Emulsion, gels, application of colloids, delta formation, medicines, sewage disposal, cleansing action of detergents and soaps, Micelles and critical micelle concentration

MODULE IV: CO ORDINATION CHEMISTRY ***9 hours***

Nomenclature, coordination number, Types of Ligands, chelates,
Geometrical, structural and stereo isomerism
Valence Bond theory, bonding in octahedral and tetrahedral complexes,
Strong and weak field ligands, high spin and low spin complexes, magnetic properties,
Drawbacks of Valence Bond theory
Application of coordination compounds in qualitative analysis-Complexation reactions in inorganic mixture analysis
Application of complexes in quantitative analysis: Metal-EDTA complexes in complexation titrations and metal complexes in gravimetric analysis

MODULE V: CHROMATOGRAPHY ***9 hours***

Outline study of Adsorption and partition chromatography,

Principle and applications of column, paper, thin layer, ion- exchange and gas chromatography
Principle and applications of HPLC
Rf and Rt value of various chromatographic techniques
Paper chromatographic separation of amino acids and sugars
Separation of a mixture of dyes by column chromatography

MODULE VI: BIOPHYSICAL ANALYSIS ***9 hours***

Osmosis, osmotic pressure, isotonic solution
Determination of molar mass by osmotic pressure method, reverse osmosis
Adsorption – types of adsorption, factors influencing adsorption
Langmuir theory of adsorption
Electrophoresis, Principle and applications of Zone electro phoresis and capillary electro phoresis

REFERENCES

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley
2. Concise Inorganic Chemistry : J. D. Lee, ELBS
3. Inorganic Chemistry : J. E. Huheey
4. Coordination Chemistry : Bosolo and Johns
5. Organic Chemistry : Peter Sykes
6. Organic Chemistry : F. A. Carey, Mc Graw Hill
7. Organic Chemistry : Morrison & Boyd
8. Reaction Mechanism of Organic Chemistry : S. M. Mukherji and S. P. Singh, Mc Millan
9. Spectrscopy Y R Sharma.
10. Advanced Organic Chemistry :Jerry March

Third Semester B.Sc Degree Examination Model question paper
Complementary course for Biochemistry Majors

CH1331.6: PHYSICAL AND ANALYTICAL CHEMISTRY - II

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1. What is Rf?

2. Name the chromatographic method where the components are separated in stacks.

3. What is a colloid?

4. What is the non-linear hybridisation in octahedral complexes?

5. What are chelates?

6. What is the unit of second order rate constant?

7. What is CMC?

8. Write the selection rule for vibrational spectrum ?

9. Write an expression for force constant ?

10. What is frequency factor? (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is zero order reaction? Give an example.

12. Write the Arrhenium equation and explain the terms.

13. What are polydendate ligands? Give an example.

14. Write a note on electrophoresis.

15. State Hardy-Schule's rule.

16. Explain Tyndall effect.

17. What is paper chromatography?

18. What are the various types of molecular spectra?

19. Discuss the various types of energy level in molecule?

20. Write in brief 'ion exchange chromatography'.

21. What are isotonic solutions.

22. What is coordination number? Explain with an example. (8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Differentiate order and molecularity.

24. Explain using valance bond theory, the bonding in tetra hedral complexes ?

25. What are high spin and low spin complexes?

26. How colloids are purified?

27. What are enzymes? Write the general properties of enzymes.

28. Give the expression for the frequency of vibration in vibrational spectroscopy and

explain the terms?

29. Explain the terms – emulstion and gel
30. What are the different types of adsorptions and the factors affecting adsorption?
31. How will you determine bond length in a molecule using microwave spectra?

(6 x 4 = 24 marks)

SECTION D

*(Answer any **two** questions. Each question carries 15 marks)*

32. a) Write a brief note on the structural isomerism in coordination complexes (6 marks)

    b) Explain the use of EDTA and dimethyl glyoxime in quantitative analysis (6 marks)

    c) Discuss the mechanism of enzyme catalysis. (3 marks)
33. a)Explain the VBT theory in octahedral complexes with examples (6 marks)

    b) Explain the magnetic properties of co-ordination compounds (5 marks)
    c) Advantages and disadvantages backs of VB theory. (4 marks)
34. a) Write a short note on adsorption and partition chromatography. (8 marks)
    b) Discuss the principle and applications of HPLC. (7 marks)
35. a)What is osmosis? How molar mass is determined by osmotic pressure method?

    (6 marks)

    b) Explain reverse osmosis and its application. (4 marks)

    c) Differentiate between zone and capillary electrophoresis. (5 marks)

(2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**IV**
COURSE	**4**
COURSE TITLE	**ORGANIC CHEMISTRY AND SPECTROSCOPY**
COURSE CODE	**CH 1431.6**
CREDIT	**3**

L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students ,*	**Cognitive Level**
1	Relate electron displacements to stability of intermediates	**U,A**
2	Comprehend substitution reactions	**A**
3	Predict R & S notations of optical isomers	**A**
4	Assign E & Z nomenclature to geometrical isomers	**A**
5	Understand the significance of rotation about single bond	**U**
6	Understand the significance of saponification value, iodine value and acid value of oils	**U**
7	Appreciate hetero cyclic compounds and alkaloids	**U**
8	Recognize the role of organo-metallic compounds in medicine	**U**
9	Have a good understanding of different spectroscopic techniques	**U**

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: MECHANISM IN ORGANIC SUBSTITUTION REACTIONS
9hours

Electron displacement in organic molecules, inductive, electromeric and mesomeric effects, hyper conjugation and steric effect

Bond fission, rate determining step

Nucleophilic substitution of alkyl halides, SN1, SN2 reactions, effect of structure on reactivity as illustrated by methyl, isopropyl and tertiary butyl groups.

Aromatic electrophilic substitution reactions (nitration, halogenations, sulphonation and Friedel Crafts alkyl and acylation) (mechanism not required), directive influence of subtituents on aromatic electrophilic substitution (-OH and -NO2 only)

MODULE II: STEREOCHEMISTRY
9hours

Optical isomerism, chirality, relative and absolute configuration, D- L notation and enantiomers

Optical isomerism in glyceraldehydes, lactic acid and tartaric acid

Diastereo isomers and meso compounds

Cahn-Ingold- Prelog rules, R-S notation for optical isomers containing one or two asymmetric carbon atoms, E and Z nomenclature in aldoximes and ketoximes

Racemic mixture, racemisation and resolution, asymmetric synthesis

Rotational isomerism, rotation about carbon – carbon single bond, conformational analysis of ethane, propane, butane. Cyclohexane, chair and boat conformations, axial and equatorial bonds (Mention only)

MODULE III: OILS, FATS, HETEROCYCLICS AND ALKALOIDS 9hours

Oils and Fats: Occurrence and extraction

Analysis of oils and fats, saponification value, iodine value and acid value

Heterocyclic systems – 5 membered, 6 membered and condensed systems

Structure of pyrrole, Furan , Thiophene and pyridine (no structural elucidation)

Electrophilic substitution in pyrrole, Furan and Thiophene Reactivity and orientation

Electrophilic and nucleophilic substitution reactions in pyridine – Basicity and reduction

Structure of purine and pyramidine bases present in nucleic acids.

Alkaloids, general method of isolation, general properties, physiological action of alkaloids

conine, morphine and nicotine(no structural elucidation expected)

MODULE IV: ORGANO METALLIC COMPOUNDS 9hours

Organo metallic compounds, Definition and classification

Grignard Reagent, preparation and synthetic applications

Ziesels salt-Bonding and Structure, preparation and use

Biological and environmental aspects of organo metallics

Organo metallics in medicine, organo mercury, boron and silicon compounds

Metal carbonyls:Iron and Nickel carbonyls, preparation- Applications – Monds Process

MODULE V: BIO INORGANIC COMPOUNDS 9 hours

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of $O_2 – CO_2$ transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

MODULE VI: SPECTROSCOPY II **9 hours**

Raman spectroscopy, stokes and antistokes lines, quantum theory of Raman spectrum, advantages and disadvantages of Raman spectrum, complementary with IR spectrum, mutual exclusion principle

NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnetic field, chemical shift, spin-spin coupling in ethyl bromide and ethanol, applications, Nuclear Resonance Imaging

ESR spectroscopy introduction and applications

REFERENCES

1. I. L. Finar, Organic Chemistry, Vol. I &II, Longman
2. Jerry March : Advanced Organic Chemistry
3. : Avinash Upadhyay.Kakoli Upadhyay.Nirmalendu Nath : Bio Physical Chemistry Principles and techniques
4. B K Sharma: Spectroscopy
5. Y R Sharma: Spectroscopy
6. J.E.Huheey, Inorganic Chemistry, Pearson.

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Bio-Chemistry Majors

Course Code CH1431.6 Credit 3

ORGANIC CHEMISTRY AND SPECTROSCOPY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

*(Answer **all** questions. Each question carries **1** mark)*

1.What is rate determining step?

2.Define Racemic mixture.

3. Represent the configurations of D and L glyceraldehyde.

4. Write an example for volatile oil .

5.What is Zieses' salt?

6.Define Iodine value.

7.Write an example for volatile oil .

8. Give the formula of iron and nickel carbonyls.

9. What is esr spectroscopy?

10. **The metal part in cytochrome.**

SECTION B

(Answer any eight questions. Each question carries 2 marks)

11. How benzene is nitrated? Give chemical equation.

12. What is steric effect?

13. Discuss the importance of Morphine.

14. Which of the following are optically active ? Why?

2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane

15. Give two differences between enantiomers and diastereoisomers.

16. What is Mond's process?

17. How are alkaloids extracted from natural sources?

18. Write any two organosilicon compounds used in medicine.

19. State mutual exclusion principle.

20. Which compound is used as standard in nmr spectroscopy? Why?

21. What is carbon cycle?

22. Explain saponification value and acid value.

SECTION C

(Answer any six questions. Each question carries 4 marks)

23. Discuss the optical isomerism of tartaric acid.

24. **Illustrate the directive influence of –NO2 group in aromatic electrophilic substitituion.**

25. **Distinguish between inductive and electromeric effect.**

26. **Comment on the classification of heterocyclics.**

27. **Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.**

28. **How organometallics are classified?**

29. **Distinguish between Stokes and antistokes lines.**

30. **Discuss the role of haemoglobin and myoglobin inO2-CO2 transportation with mechanism**

31. **Differentiate fats and oils.**

SECTION D

(Answer any two questions. Each question carries 15 marks)

32. (a)Discuss the mechanism of SN1 and SN2 reactions (6 marks)

(b)Effect of structure of alkyl group on SN1 and SN2 reactions(5 marks)

(c)What is Friedel-Crafts alkyl and acylation. (4 marks)

33. (a) Why furan undergoes electrophilic substitution at 3-position.(4 marks)

(b) Discuss the important electrophilic substitution reactions of furan (6 marks)

(c)Write the structure of purine and pyrimidine bases (5 marks)

34. (a)What is resolution? Explain any three methods of resolution. (7 marks)

(b)What are meso compounds? Are they optical active? Explain with a suitable example.(4 marks)

(c)Discuss the conformational analysis of butane. (4 marks)

35. (a) What is Grignard reagent? How is it prepared? (3 marks)

(b) How Grignard reagent is useful to synthesis primary, secondary and tertiary alcohols (3 marks)

(c)Discuss the nmr spectrum of ethyl bromide. (5 marks)

(d) Explain chemical shift (3 marks) **(2 x 15 = 30 marks)**

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR BIOCHEMISTRY**
COURSE CODE	**CH 1432.6**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR BIOCHEMISTRY MAJORS

Course Code CH1432 .6 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY (FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**GENERAL CHEMISTRY - I**
COURSE CODE	CH1131 .7
Credit	2
HOURS	36
L-T-P	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the Bohr atom model and represent electronic configuration of elements	R,U
2	Predict the shape of molecules	A
3	Explain the significance of hydrogen bonding	U
4	Discuss the theory of volumetric analysis	U
5	Point out the major sources of air and water pollution and its environmental impact.	U

MODULE I – ATOMIC STRUCTURE (9 HRS)

Atomic spectrum of hydrogen - different series, Rydberg equation.

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.
Schrodinger wave equation (mention only, no derivation), concept of orbitals.
Quantum numbers and their significances.
Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.
Electronic configuration of lanthanides and actinides, Lanthanide contraction

MODULE II – CHEMICAL BONDING (9 HRS)

Energetics of ionic bond formation – Born-Haber cycle. Fajan's rule.

Hybridisation and shape of molecules – sp (BeCl2), sp^2(BF3) , sp^3 (CH4), sp^3d(PCl5), sp^3d^2 (SF6) and sp^3d^3 (IF7)

hybridisation with examples.

VSEPR theory, regular and irregular geometry, H2O, NH3, XeF2, XeF4.

Hydrogen bond – inter and intra molecular – its consequences on boiling point and

volatility. Importance of hydrogen bonding in biomolecules – Proteins and nucleic acids.

Ionic character of covalent bond – Polar and non polar covalent compounds.

MODULE III – ENVIRONMENTAL CHEMISTRY (9HRS)

Nature of environmental threats and role of chemistry.

Air pollution – Air pollutants and their sources, toxic effect of CO, acid rain.

Green house effect, ozone layer and its depletion.

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents.

Treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.

Dissolved oxygen-BOD,COD analysis.

MODULE IV – ANALYTICAL PRINCIPLES (9 HRS)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity.

Theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations.

Theory of acid-base indicator – redox indicators.

Principles of colorimetry – estimation of biomolecules - glucose and chlorophyll.

Text books/References:

1. B.R.Puri, L.R.Sharma and P.S.Kalia "Inorganic chemistry",
2. A.I.Vogel "A text book of Quantitative analysis"
3. Day & Underwood. "Qunatitative analysis: laboratory manual":
4. G.S.Manku. "Theoretical Principles of Inorganic Chemistry":
7. S. K. Banerji, "Environmental Chemistry".
8. A. K. De "Environmental Chemistry - An introduction"
9. B. K. Sharma "Air Pollution".

UNIVERSITY OF KERALA

I Semester Bsc Degree Examination Model Question Paper
Complementary Chemistry Course for Microbiology Majors

Course Code CH1131.7 Credit 2

GENERAL CHEMISTRY - I

(2020 Admission onwards)

Time: Three Hours Maximum Marks: 80

Section A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Identify the hybridization in $BeCl_2$.
5. Give the structure of XeF_2.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Answer any 8 questions from the following. Each question carries two marks

11. What is Bohr Bury's rule?

12. Write down the Schrodinger Equation and explain the terms involved.

13. Explain the failures of Bohr's theory?

14. What are the limitations of VSEPR Theory?

15. What are polar and non polar covalent bonds?

16. Which is more volatile, o-nitro phenol or p-nitro phenol? Why?

17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?

19. Methyl orange is not a suitable indicator for the titration of weak acid with

strong base. Why?

20. Which are green house gases? Mention their sources.

21. What is reverse osmosis? How it is useful in the purification of waste water?

22. What are chief factors responsible for water pollution?

SECTION-C

Answer any 6 questions from the following. Each question carries four marks.

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?

24. Explain the stability of half filled and completely filled orbitals.

25. Give an account of permanganometric titrations.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Fajan's rule.

30. Write a note on agricultural pollution.

31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION-D

Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits . (6 marks)
(b)What are quantum numbers? Give its significance. (3 marks)
(c) Explain various rules regarding electronic configuration. (6 marks)

33. (a) Discuss the titration curves for the titration of strong acid with strong base and
weak acid with strong base. (6 marks)
(b) Explain the theory of redox indicators. (5 marks)
(c) State and explain Beer – Lambert Law. (4marks)

34. (a) Write a note on Hydrogen bonding . (4 maks)
(b) Discuss the consequences of hydrogen bonding. (5 marks)
(b) Account for the bond angle difference in NH3 and H2O using VSEPR theory.(5 marks)
(c) Calculate the bond order of O_2, O_2^{2+} and O_2^{2-} and arrange them in the increasing order of stability.(4 marks)

35. (a) Discuss the formation and importance of ozone layer. (5 marks)
(b) What is meant by pollution and pollutants? Describe the various air pollutants and their sources. (5 marks)
(c) What is acid rain? How is it happens? Write its impact on environment. (5 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY
(FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**II**
COURSE	**2**

COURSE NAME	**GENERAL CHEMISTRY II**
COURSE CODE-	CH1231 .7
Credit	2
HOURS	36
L-T-P	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the stereochemistry of organic compounds	R,U
2	Discuss radioactivity and its applications	A
3	Summarize the chemistry of coordinate compounds	U
4	Explain the role of chlorophyll, haemoglobin, myoglobin, and elements in biological functions.	U
5	Solve numerical problems on radioactivity	U
6	Develop scientific attitudes curiosity against the biological effect of radiations	

MODULE I – STEREOCHEMISTRY (9 HRS)

Optical isomerism, chirality, enatiomers, diastereoisomers, racemisation and resolution.

Relative and absolute configuration – CIP rules (D- & L- Glyceraldehyde, D- & L- lactic acid and +,- and meso tartaric acid only)

Asymmetric synthesis, Enantiomeric excess.

Geometrical isomerism, E and Z nomenclature to Aldoximes, ketoximes, simple alkenes, maleic and fumaric acid.

Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, butane, cyclohexane, axial and equatorial bonds.

MODULE II- RADIOACTIVITY AND NUCLEAR CHEMISTRY (9 HRS)

Radioactive decay series, Radioactive equilibrium, Average life, Half life.

Detection of radio activity-Geiger Muller Counter, Wilson cloud chamber.

Units of radioactivity-Curie and Rutherford, Units of radiations.

Nuclear Chemistry-stability of nucleus, n/p ratio.

Artificial transmutation and radioactivity, mass defect, binding energy.

Applications of radio activity- in medicine and agriculture.

Biological effects of radiation, pathological and genetic damage.

MODULE III- CO-ORDINATION CHEMISTRY AND SECONDARY BOND FORCES (9 HRS)

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory.

Crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties.

Application in qualitative and quantitative analysis.

Secondary bond forces in molecules – Ion-dipole, dipole-dipole, ion-induced dipole, dipole-induced dipole and induced dipole-induced dipole interactions.

MODULE IV – HETEROCYCLIC AND BIO INORGANIC COMPOUNDS (9HRS)

Structure of furan, pyrrole, thiophene, 1,3-diazole, 1,3-thiozole, pyridine, 1,3-diazine, indole, quinoline, isoquinoline, purine and pyramidine bases.(structure only)

Aromaticity of five and six membered heterocyclics.

Metalloporphyrins – cytochromes, chlorophyll, photosynthesis and respiration, haemoglobin and myoglobin, mechanism of O2 – CO2 transportation.

Biological fixation of nitrogen

Carbon fixation and carbon cycle.

Role of alkali and alkaline earth metals in biological systems

Biological functions and toxicity of Cr, Mn, Ni, Cu, Se, Mo, Co ,Fe & Zn.(mention only)

Text Books /References

1. Bosolo and Johns Co-ordination Chemistry
2. Rochoco, Chemistry of Organometallics
3. J.D. Lee, Concise Inorganic Chemistry
4. Puri, Sharma and Kalia "Inorganic Chemistry"
5. A.D. Madan Modern Inorganic Chemistry

UNIVERSITY OF KERALA

II Semester Bsc Degree Examination Model Question Paper

Complementary Chemistry Course for Microbiology Majors

Course Code CH1231.7 Credit 2

GENERAL CHEMISTRY II

(2020 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

Answer all questions. Answer in one word to maximum two sentences. Each question carries one mark.

1. What is chirality?
2. Draw the structure of D-glyceraldehyde and L-glyceraldehyde.
3. What are conformers?
4. What are alpha particles?

5. Define the term radioactivity.
6. Give an example for hexadendate ligand.
7. What are low spin complexes?
8. What do you mean by chelate?
9. Draw the structure of furan and pyrrole?
10. Give an example of anaerobic respiration.

SECTION-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is racemisation? Comment on its optical activity.
12. What are diastereoisomers? Give examples.
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. Mention the biological functions of Cr and Zn?
22. What is the role of chlorophyll in photosynthesis?

SECTION-C

Short essay (not exceed 120 words). Answer any 6 questions from the following. Each question carries four marks.

23. Discuss the geometrical isomerism of maleic and fumaric acid. Also assign E and Z notation.
24. Explain the conformarism of cyclohexane.
25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How Long will it take for the radioactivity to fall to 10% of the initial value?
26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation

.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss the aromaticity of heterocyclic compounds.

31. Metal ions play a variety of roles in biological systems. Explain

SECTION-D

Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) What is resolution? Explain any three methods of resolution (7 marks)

(b) Apply CIP rules to find out the absolute configuration of + & - lactic acid

(5marks).

(c) Discuss asymmetric synthesis with an example. (3 marks)

33.(a) Discuss the applications of radioactivity in medicine and agriculture (5 marks)

(b) Describe any one method of detecting radioactivity (5 marks)

(c) Explain artificial radioactivity with suitable examples. (5 marks)

34. (a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5marks)

(c)Write a brief note on secondary bond forces. (5 marks)

35. (a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARYCHEMISTRY
(FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**III**
COURSE	**3**
COURSE NAME	BIOMOLECULES & BIOPHYSICAL CHEMISTRY - I
COURSE CODE-	CH1331 .7
Credit	2
HOURS	**54**
L-T-P	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the chemistry and structure of biologically important carbohydrates	U
2	Describe the synthesis of amino acids and polypeptides	A
3	Understand the structure of protein and nucleic acids	U
4	Explain the classification of lipids, their structure and biological importance.	U
5	Understand the role of buffers, importance of osmosis and to prepare standard solutions.	U
6	Explain the basic concepts of kinetics of chemical reactions	U

MODULE I – CARBOHYDRATES (12 HOURS)

Classification, configuration of D & L glyceraldehydes. Structure of ribose, 2-deoxy ribose, glucose, fructose, mannose and galactose.

Properties of glucose and fructose - due to functional groups - hydroxyl, aldehyde and ketone, action of acids and alkali on sugars, Reducing actions of sugars.

Pyranoside structures of glucose and fructose.

Furanoside structure of fructose (structure elucidation not expected).

Mutarotation and epimerization.

Glycosides and amino sugars.

Structure and biological importance of disaccharides - sucrose, lactose, maltose and cellobiose**.** Inversion of sucrose.

Structure and important properties of the following structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen).

Glycosaminoglycans- heparin, hyaluronic acid.

MODULE II – AMINO ACIDS AND PROTEINS (12 HRS)

Amino acids -Classification and properties, Essential and non essential amino acids, zwitter ion, isoelectric point

Synthesis of amino acids - glycine, alanine and tryptophan .

Polypeptides and proteins - peptide linkage.

Peptide synthesis - Carbobenzoxy, Sheehan and solid phase synthesis

Proteins - primary, secondary, tertiary and quarternary structure of proteins.

Denaturation and colour reactions of proteins.

RNA and DNA – Structure of purines and pyrimidines, nucleosides, nucleotides, phosphodiester linkages.

Hydrolysis of nucleoproteins, structure of nucleic acids. their biological role.

Replication of DNA.

MODULE III – LIPIDS (12 HOURS)

Lipids: Definition, basic ideas about the biochemical functions of lipids.

Classification of lipids with examples, classification of fatty acids, physical and chemical properties of fatty acids.

Structure of the following fatty acids- stearic acid, oleic acid, linoleic acid, arachidonic acid. Structure of triacylglycerol.

Saponification number, acid number and iodine number of fats.

Essential and non-essential fatty acids with examples.

Compound lipids: membrane lipids- Structure and functions of phospholipids- phosphatidic acid, lecithin, cephalin, and phosphatidyl serine, Functions of Sphingolipids.

Steroids: Strucutre and functions of cholesterol and ergosterol.

MODULE IV – ACIDS, BASES AND BUFFERS (6 HRS)

Dissociation of water, ionic product of water, concepts of pH, pOH, simple numerical problems of pH.

Determination of pH using indicators, pH meter and theoretical calculations.

Dissociation of weak acids and electrolytes, Bronsted and Lewis theory of acids and bases,

Meaning of Ka and pKa values,

Buffers: buffer action, buffers in biological system,

Henderson -Hasselbach equation with derivation, simple numerical problems involving application of this equation.

MODULE V: SOLUTIONS (6H)

Meaning of normality, molarity, molality, percentage solution, mole fractions, simple numerical problems from the above, Fundamental principles of diffusion and osmosis, biological importance of osmosis. Isotonic, hypotonic and hypertonic solutions.

MODULE VI - CHEMICAL KINETICS (6HRS)

Rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions. Rate determining step.

Derivation of first order kinetics - fractional life time, units of rate constants.

Influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters.

REFERENCES

1) Dr.U.Satyanarayana and Dr.U.Chakrapani,Biochemistry, Books and Allied (P) Ltd

2) J.L.Jain, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry, , S.Chand & Co. Ltd.

3) RK Murray, DK Granner, PA Mayers, VW Rodwell, Harper's Biochemistry, Prentiace-Hall International Editions.

4) Sharma,Madan and Pahania, Principles of Physical Chemistry, Vishal Publishing Co.

UNIVERSITY OF KERALA

III Semester Bsc Degree Examination Model Question Paper

Complementary Chemistry Course for Microbiology Majors

Course Code CH1331.7 Credit 2

BIOMOLECULES & BIOPHYSICAL CHEMISTRY - I

(2020 Admission onwards)

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1) Write the epimer of D-Glucose.
2) What are polysaccharides?
3) What are zwitter ions?
4) Relationship between the base sequence in DNA and the amino acid sequence in protein is known as ……………..
5) Write the structure of tryptophan.
6) Name the purine bases present in DNA.
7) Explain the term rate determining step.
8) Mention about the concepts of pH& pOH.
9) Prepare 2M ,250 ml NaOH solution.(mol wt of NaOH = 40)
10) What is unit of first order reaction?

(10x1=10 marks)

SECTION B

(Answer any 8 question. Each question carries 2 Marks)

11) Draw the structure of cellulose.
12) Explain inversion of cane sugar.
13) What is Tollen's reagent. Write its importance.
14) Explain denaturation of protein.
15) Differentiate essential and non-essential amino acids?
16) Name the products of hydrolysis of nucleoproteins.
17) Write the functions of cholesterol.
18) Explain saponification value.
19) Calculate the pH of 0.001M HCl.
20) What is buffer?
21) What is a first order reaction? Give an example.
22) Write Arrhenius equation and explain the terms. (8x2=16 marks)

SECTION C

*(Answer **any 6** question. Each question carries 4 Marks)*

23) Write a short note of glycosaminoglycans.
24) Give the chemical properties of glucose due to hydroxyl and carbonyl functional groups.
25) Explain mutarotation and epimerization.
26) Explain the following denaturation and colour reactions of protein.
27) Write the structure and functions of cholesterol and ergosterol.
28) Differentiate Saponification number and iodine number. Write its importance.
29) Derive first order rate equation.
30) Explain Bronsted theory of acids and bases.
31) Write any one method of synthesizing glycine and tryptophan (6x4=24marks)

SECTION D

(Answer any 2question. Each question carries 15 Marks)

32) (a) Discuss the pyranoside structure of glucose.

(b) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine (iii) CH_3OH and dry Conc.HCl. (iv) Tollen's reagent.

(c) Write a short note on storage polysaccharides. (6+4+5)

33) (a) What are lipids? Discuss the biological functions of lipids.

(b) How fatty acids are classified? Discuss it with examples and structure.

(c) Write short notes on lecithin and cephalin. (4+6+5)

34) (a) Explain two methods of synthesizing peptides.

(b) Discuss primary and secondary structure of proteins.

(c) Discuss the biological role of DNA. (5+5+5)

35) (a) Derive Henderson-Hasselbach equation. Write the importance of the equation?

(b) Explicit the importance of osmosis in biological systems.

(c) Discuss the various factors influencing rate of reaction. (6+4+5)

(2x15=30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY (FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**IV**
COURSE	**4**
COURSE NAME	**BIOMOLECULES & BIOPHYSICAL CHEMISTRY - II**
COURSE CODE-	CH1431 .7
Credit	2

HOURS	**54**
L-T-P	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the classification of enzymes and their biological importance.	U
2	Outline the metabolism of carbohydrates, fatty acids and proteins.	U
3	Explain the importance of UV, IR and NMR spectroscopic techniques as analytical tool.	U
4	Explain the basic concepts of thermodynamics and relevance of themodynamics in biological processes.	U
5	Discuss the classification of colloids and their synthesis and applications.	U

MODULE I – INTRODUCTION TO ENZYMES (12HRS)

Enzymes – Chemical nature and Features of active site.

Enzyme Specificity – Stereo, reaction, substrate and broad specificity.

Enzyme Commission system of classification and nomenclature of enzymes: six major classes of enzymes with one example each.

Coenzymes and their functions - NAD, NADP+, FAD, FMN, lipoic acid, pyridoxal phosphate, biotin and cyanocobalamin. Ribozymes,

Measurement and expression of enzyme activity, Definition of IU, katals, enzyme turnover number .

Isoenzymes- Lactate dehydrogenase

Applications of enzymes – Enzymes as therapeutic agents, as analytical reagents, immobilized enzymes.

MODULE II : ENZYME KINETICS (6H)

Factors affecting enzyme catalysed reactions - effect of substrate concentration, enzyme concentration, temperature, pH and activators.

Mechanism of Enzyme action - Activation energy, Interaction between enzyme and substrate- lock and key model, induced fit model.

Enzyme kinetics - Km and its significance, Michaelis Menton equation (without derivation), Lineweaver- Burk plot.

Significance of Km and Vm values.

MODULE III: INTRODUCTION TO METABOLISM (9HRS)

Metabolism- catabolism and anabolism

Metabolism of carbohydrates – Glycolysis and citric acid cycle, Electron transport chain and Oxidative phosphorylation.

Glycogenesis and glycogenolysis, Gluconeogenesis (Mention only)

Metabolism of lipids - Metabolism of triglycerides, Outline study of β-oxidation of saturated and unsaturated fatty acids.

Metabolism of amino acids – Proteolysis, Urea cycle.

MODULE IV – ORGANIC SPECTROSCOPY (9 HRS)

Spectroscopic techniques: Principle and applications of UV and Visible spectroscopy – types of electronic transitions, concept of chromophore and auxochrome – red and blue shifts – applications.

IR spectroscopy – Molecular vibrations, vibrational frequency-bond strength relation, Functional group and finger print region – group frequencies, effect of hydrogen bonding on –OH stretching frequency.

NMR spectroscopy – nuclear spin, principle of NMR, chemical shift, spin-spin interation.

PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI.

MODULE V: BIOENERGETICS (9HRS)

Basic concepts – System – surroundings – open, closed and isolated systems – Isothermal – isochoric and isobaric process.

Biochemical thermodynamics, first and second law of thermodynamics, Enthalpy, Entropy and Free energy.

Criteria for reversible and irreversible process - Gibbs free energy equation.

Relationship between standard free energy change and equilibrium constant.

Standard free energy changes at pH 7.0 ($\Delta G'$), additive nature of $\Delta G'$, ATP as universal currency of free energy in biological systems.

MODULE VI- COLLOIDS (9HRS)

Meaning of true solution, colloidal solution, and coarse suspension, distinction between lyophilic and lyophobic sols, Fundamental study of Donnan equilibrium- application in biological system, membrane permeability, methods of preparation of colloidal solution, separation of colloidal solutions, elementary study of charge on colloids, Tyndall effect, emulsion and emulsifying agents, application of colloidal chemistry.

References:-

5) Biochemistry, Dr,U.Satyanarayana and Dr.U.Chakrapani, Books and Allied (P) Ltd

6) Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, S.Chand & Co. Ltd.

7) Harper's Biochemistry, RK Murray, DK Granner, PA Mayers, VW Rodwell, Prentiace-Hall International Editions.

8) Principles of Physical Chemistry, Sharma,Madan and Pahania, Vishal Publishing Co.

UNIVERSITY OF KERALA

IV Semester Bsc Degree Examination Model Question Paper
Complementary Chemistry Course for Microbiology Majors

Course Code CH1431.7 Credit 2

BIOMOLECULES & BIOPHYSICAL CHEMISTRY - II

(2020 Admission onwards)

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1. What is holoenzyme?
2. What is LB plot?
3. What is enzyme turnover number?
4. What is glycogenesis?
5. Define catabolism
6. Write the mathematical form of Beer Lamber's Law.
7. Write the useful region in IR spectroscopy.
8. Define open and closed systems.
9. What is entropy?
10. What is a colloidal solution. (10x1=10 marks)

SECTION B

(Answer any 8 question. Each question carries 2 Marks)

11. Write down any 4 industrial uses of enzymes?
12. Define IU and katal?
13. Explain the significance of km value?
14. Differentiate catabolism and anabolism.
15. What is phosphorylation?
16. What are chromophores? Give examples.
17. Write the stretching frequency of (i) carbonyl group and (ii) free

–OH group.

18. Differentiate glycogenolysis and Gluconeogenesis

19. State and explain first law of thermodynamics.

20. Distinguish isothermal and isobaric process.

21. Explain Tyndall effect.

22. What are emulsifying agents? Give examples. (8x2=16 marks)

SECTION C

*(Answer **any 6** question. Each question carries 4 Marks)*

23. What is Michaelis Menton equation? Explain?

24. Briefly explain factors affecting velocity of enzyme catalyzed reactions?

25. What are co-enzymes? Write any two co-enzymes and their functions.

26. Illustrate urea cycle.

27. (i) What is fingerprint region? (ii) Comment on the influence of hydrogen bonding on O-H stretching frequency.

28. What is chemical shift? Explain the factors influencing chemical shift.

29. Describe any two methods of preparation of colloidal solution.

30. Derive the relationship between standard free energy change and equilibrium

constant.

31) Differentiate lyophilic and lyophobic colloids. (6x4=24marks)

SECTION D

(Answer any 2question. Each question carries 15 Marks)

32. (a) Give an account of classification of enzymes?

(b) Write down any 4 industrial uses of enzymes.

(c) Explain immobilization of enzymes? (8+4+3)

33. (a) Explain the reaction sequences happening in kerb's cycle?

(d) Give an account on saturated fatty acid oxidation. (8+7)

31. (a) Explain the principle of NMR spectroscopy.

(d) What is spin-spin interaction? Explain with an example

(e) Discuss on the applications of UV-Vis spectroscopy

(6+6+3)

32. (a) Comment on the statement “ATP as universal currency of free energy in
biological systems”

(d) Explain the importance of free energy to predict the feasibility of reactions.

(e) Discuss the various applicatiaons of colloids. (6+4+5)

(2x15=30 marks)

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF MICROBIOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR MICROBIOLOGY**
COURSE CODE	**CH 1432.7**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A

	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallize	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR MICROBIOLOGY MAJORS

Course Code CH1432 .7 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters

File Ref.No.27521/Ac A V/2020/UOK

UNIVERSITY OF KERALA

(Abstract)

Scheme and Syllabus of First Degree Programme in Chemistry and complementary courses in Chemistry for Physics/Geology/Botany/Zoology/Home Science/Biochemistry /Microbiology under CBCS system- with effect from 2020 admission- Approved- Orders issued.

Ac A V

3441/2020/UOK Dated: 03.11.2020

Read:-1.U.O.No.Ac.AV/1/chemistry/2017 dated 13.06.2017

2.Item.No.IV (E).I and IV [E (a)] of the Minutes of the meeting of the Faculty of Science held on 17.08.2020.

3.Item.No.II.(vii) of the Minutes of the meeting of the Academic Council held on 27.08.2020

ORDER

The scheme and syllabus of First Degree Programme in Chemistry under CBCS system (Core, Complementary, Foundation, Open and Elective courses) had been revised vide paper read as (1) above.

The annual meeting of the Board of Studies in Chemistry (pass) held on 22.11.2019 has recommended the revised outcome based scheme and syllabus of First Degree Programme in Chemistry and complementary courses in chemistry for other First Degree Programmes (Physics, Geology, Botany, Zoology, Home science Biochemistry and Microbiology) to be implemented w.e.f 2020 admission and the same has been endorsed by the Faculty of Science vide paper read as (2) above.

The Academic Council vide paper read as (3) above, resolved to approve the outcome based scheme and syllabus of First Degree Programme in Chemistry and complementary courses in chemistry for other First Degree Programmes (Physics, Geology, Botany, Zoology, Home science Biochemistry and Microbiology) to be implemented with effect from 2020 admissions, as recommended by the Board of Studies in Chemistry (pass) and as endorsed by the Faculty of Science.

The syllabi are available in the University Website (www.keralauniversity.ac.in).

Orders are issued accordingly.

ANITHA D

DEPUTY REGISTRAR

For REGISTRAR

To

1.PS to VC/PVC
2.PA to Registrar/CE
3.The Director,KUCC
4.The Principals of colleges offering First Degree Programmes
5.The Dean, Faculty of Science
6.The Chairman, Board of Studies in Chemistry (pass)
7.JR (CBCS/Academic)
8.DR (CBCS/EB/ES)
9.AR(CBCS/EB/ES/BA/B.Sc/B.Com)
10.AR (IT cell) Exams
11.All Tabulation sections(CBCS)
12.PRO/RO/Enquiry
13.Stock file/File copy

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Section Officer