UNIVERSITY OF KERALA

B.Sc. DEGREE PROGRAMME IN CHEMISTRY

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

SCHEME AND SYLLABI

2013 ADMISSION ONWARDS

Core Courses, Foundation Course II, Open and Elective Courses

B.Sc. Degree Chemistry Programme

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 indepth 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, Table V gives distribution of Complementary Courses in different Semesters, and Table VI gives the consolidation of Grade of a Course.

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		Total Credit
			T	P			CE	ESE	
I	EN1111	English I	5		4	3hrs	25%	75%	18
	1111	Additional Language I	4		3	3hrs	25%	75%	
	EN1121	Foundation Course I	4		2	3hrs	25%	75%	
	MM1131.2	Complementary Course I	4		3	3hrs	25%	75%	
	PY1131.2	Complementary Course II	2		2	3hrs	25%	75%	
		Complementary Course Lab of PY1131.2		2	-	-	-	-	
	CH1141	Core Course I	2		4	3hrs	25%	75%	
		Core Course Lab I of CH1141		2	-	-	-	-	
II	EN1211	English II	4		3	3hrs	25%	75%	18
	EN1212	English III	5		4	3hrs	25%	75%	
	1211	Additional Language II	4		3	3hrs	25%	75%	
	CH1221	Foundation Course II	2	2	3	3hrs	25%	75%	
	MM1231.2	Complementary Course III	4		3	3hrs	25%	75%	
	PY1231.2	Complementary Course IV	2		2	3hrs	25%	75%	
		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	25%	75%	18
	1311	Additional Language III	5		4	3hrs	25%	75%	
	MM1331.2	Complementary Course V	5		4	3hrs	25%	75%	
	PY1331.2	Complementary Course VI	3		3	3hrs	25%	75%	
		Complementary Course Lab of PY1331.2		2	-	-	-	-	
	CH1341	Core Course II	3		3	3hrs	25%	75%	
		Core Course Lab I of CH1341		2	-	-	-	-	
IV	EN1411	English V	5		4	3hrs	25%	75%	24
	1411	Additional Language IV	5		4	3hrs	25%	75%	
	MM1431.2	Complementary Course VII	5		4	3hrs	25%	75%	
	PY1431.2	Complementary Course VIII	3	2	3	3hrs	25%	75%	
	PY1432.2	Complementary Course Lab of PY1131.2, PY1231.2, PY1331.2 & PY1431.2			4	3hrs	25%	75%	
	CH1441	Core Course III	3		3	3hrs	25%	75%	
	CH1442	Core Course IV- Lab I of CH1141, CH1341 & CH1441		2	2	3hrs	25%	75%	

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	
V	CH1541	Core Course V	3		4	3hrs	25%	75%	19
	CH1542	Core Course VI	4		4	3hrs	25%	75%	
	CH1543	Core Course VII	4		4	3hrs	25%	75%	
	CH1544	Core Course VIII Lab II		5	3	3hrs	25%	75%	
	CH 1545	Core Course IX Lab III		4	2	3hrs	25%	75%	
	1551	Open Course	3		2	3hrs	25%	75%	
		Project		2	-	-	-	-	
VI	CH1641	Core Course X	3		4	3hrs	25%	75%	23
	CH1642	Core Course XI	4		4	3hrs	25%	75%	
	CH1643	Core Course XII	4		4	3hrs	25%	75%	
	CH1644	Core Course XIII Lab IV		5	3	3hrs	25%	75%	
	CH1645	Core Course XIV Lab V		3	2	3hrs	25%	75%	
	CH1661.1/ CH1661.2/ CH1661.3/ CH1661.4	Elective Course	3		2	3hrs	25%	75%	
	CH1646	Project and Factory Visit		3	4	Viva voce	-	100%	

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+19+23 =120.

B.Sc. Degree Programme in Chemistry
Table II. Scheme of Instruction of Core Courses, Foundation Course II, Open Course and Elective Course
2013 admission onwards

Course number	Course Code	Course Title	Semester I			Semester II			Semester III			Semester IV			Semester V			Semester VI			V Total	
			Contact Hours		Credit	Contact Hours		Credit	Contact Hours		Credit	Contact Hours		Credit	Contact Hours		Credit	Contact Hours		Credit	Contact Hours	Credit
			T	P		T	P		T	P		T	P		T	P		T	P			
C.C. I	CH1141	Inorganic Chemistry I	2		4																2	4
F.C. II	CH1221	Methodology and Perspectives of Sciences and General 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	Physical Chemistry II													4		4				4	4
C.C. VIII	CH1544	Lab Course II (Inorganic volumetric analysis)														5	3				5	3
C.C. IX	CH1545	Lab Course III (Physical chemistry experiments)														4	2				4	2
O. C	CH1551	Any One of the Options													3		2				3	2
C.C. X	CH1641	Organic 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.

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

B.Sc. Degree Programme in Chemistry
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 Semesters
Complementary Courses -4 Total Credits – 14
One 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

Table VI. Consolidation of Grade of a course

Exam	**Grade**	**Grade points(G)**	**Weightage (W)**	**Weighted grade points (WxG)**
CE			**1**	
ESE			**3**	
Total			**4**	
Grade of Course		Total weighted grade points / Total weightage =		

GENERAL ASPECTS OF EVALUATION

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

Evaluation of each course shall involve Continuous Evaluation (CE) with a weightage of 25 % and End Semester evaluation (ESE) with a weightage of 75 %. A system of performance based direct grading will be used with Grades A-E and the Grade Points as shown below.

Performance	**Grade**	**Grade Point**	**Grade Range**
Excellent	A	4	3.50-4.00
Very Good	B	3	2.50-3.49
Good	C	2	1.50-2.49
Average	D	1	0.50-1.49
Below Average	E	0	0.00-0.49

I. 1. CONTINUOUS EVALUATION FOR LECTURE COURSES

The Continuous evaluation will have 25% percentage weightage 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

Grades A-E will be awarded for each component. 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.

Total weightage is 10.

I. 1. Components of CE For Lecture Courses			
No	**Component**	**Weight**	**Grades**
1	Attendance	**1**	>90% - A <90 - >85% - B <85 - >80% - C <80 - >75% - D <75% - E
2	Assignment / Seminar	**1**	A-E
3	Two tests*	**2**	A-E
		4	A-E

*** Average of the two tests will be taken**

I. 1. 1. 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. Both the assignment and the seminar will first be evaluated by awarding grades A-E based for each of the four components below in Table I.1.1. The seminar is to be conducted within the contact hour allotted for the course.

I. 1. 1. Mode of Assignments / Seminar Evaluation		
No	**Main Component**	**Grades**
1	Adherence to overall structure &submission deadline	All four main components present & satisfactory : A Only three : B Only two : C Only one : D None : E
2	Content & grasp of the topic	
3	Lucidity / Clarity of presentation	
4	References / Interaction/Overall effort	

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.

I. 1. 1. 1. Guidelines for Assignments / Seminar Evaluation		
No	Main Component	Sub-Components
1	Adherence to overall structure & submission deadline	i. Punctual submission ii. Adequate length/duration iii. Inclusion of Introduction, Discussion & Summary sections iv. Absence of errors/mistakes
2	Content & grasp of the topic	i. Coverage of topic ii. Understanding of topic iii. Logical organization iv. Originality (No copying from a source or plagiarism)
3	Lucidity / Clarity	i. Clarity ii. Effective presentation/delivery iii. Neatness of presentation iv. Inclusion of appropriate diagrams /equations /structures etc

4	References / Interaction/Overall effort	i. Listing of references ii. Use of more than one reference source/Use of Web resource iii. Correct Response to quiz /questions iv. Overall effort in preparing assignment/seminar

I. 1. 2. DETAILS OF THE CLASS TEST

1. The test has a duration of 1½ hours.
2. Each question paper has four parts: A, B, C and D and the weightage are shown in Table I.1.2.
3. Part A contains two questions. Each question contains four sub questions. Each question has a weight = 1. The questions may be in the forms - multiple choices match the following, name the following or fill in the blanks or any one word- answer question (Objective).
4. Part B contains five questions. Out of these, the students have to answer three questions. Each answer should contain four points. Each question has a weight = 1(Short Answer).
5. Part C contains five questions of which the candidate has to answer three. Each question has a weight = 2. The answer must contain 8 points (Short Essay).
6. Part D contains two questions of which the candidate has to answer one. Each question has a weight = 4. Each answer must contain 16 points (Long Essay).
7. Total weightage for the entire questions to be answered is 15.

I. 1. 2. Question Paper Pattern for Class Test			
Question No	**No and Type of Question**	**Weight**	**Weighted grade point**
Part A: I.1-4; II. 4-8	2 Objective/fill up the blanks/one word	1	2
Part B: 9-13	3 out of 5; Short Answer	1	3
Part C: 14-18	3 out of 5; Short Essay	2	6
Part D: 19-20	1 out of 2; Long Essay	4	4 Total = 15

I. 2. CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation will have 25% percentage weightage. For 5th semester, only CE evaluation will be done; the corresponding ESE will be in 6th semesters. Grades A-E will be awarded for each component. There will be two quizzes / tests for which, the better of the two grades obtained will form part of CE. The CE components are:

(i) Attendance for laboratory sessions
(ii) Experiment (Lab) Report on completion of each set of experiments
(iii) Laboratory Skill and
(iv) Quiz / Test.

These are summarized below in Table I. 2. Total Weightage is 10.

I. 2. Components of CE For Lab Courses

No	Component	Weightage	Grades
1	Attendance	**1**	>90% - A <90 - >85% - B <85 - >80% - C <80 - >75% - D <75% - E
2	Experiment (Lab) Report	**1**	A-E [See Table I. 2. 1. Below]
3	Laboratory Skill	**1**	A-E [See Table I. 2. 2. Below]
4	Quiz / Test	**1**	A-E [See I. 2.3. below]

The guidelines for evaluating the two main components 2-4 using sub-component are presented below.

I. 2. 1. EVALUATION OF THE EXPERIMENT (LAB) REPORT

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.

I. 2. 1. Mode of EXPERIMENT (LAB) Report Evaluation		
No	**Sub Component**	**Grades**
1	Punctual submission and Neat presentation	All four sub-components present & satisfactory : A Only three : B Only two : C Only one : D None : E
2	Inclusion of aim, materials, procedure etc	
3	Calculations and absence of errors/mistakes	
4	Accuracy of the result	

I. 2. 2. EVALUATION OFTHE LAB SKILL

Mode of Lab Skill Evaluation		
No	**Sub Component**	**Grades**
1	Punctuality and experiment completion on time	All four sub-components : A Only three : B Only two : C Only one : D None : E
2	Lab skill & Neat arrangements of table and apparatus in lab	
3	Prompt and neat recording of observations in lab note book	
4	Experimental Skill and attention to safety	

I. 2. 3. EVALUATION OF THE LAB QUIZ /TEST

The test for a lab course may be in the form of a quiz and two such tests are to be conducted. Based on the performance in answering the quiz, grades A-E may be awarded and the better grade earned in these two will be counted for CE. Two teachers, one of which is the course teacher, should conduct the quiz/test within the assigned lab contact hours.

II. 1. END SEMESTER EVALUATION FOR LECTURE COURSES

The end semester evaluation will be done by the University at the end of the semester and it will have a 75% percentage weightage. End of semester University theory examination will be of 3-hr duration. Grades A-E will be awarded as per Regulations and the general aspects of evaluation

II. 1. 1. END SEMESTER QUESTION PAPER PATTERN

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 four questions. Each question contains four sub questions. Each question has a weight = 1. The questions may be in the forms - multiple choices, match the following, name the following or fill in the blanks or any one word- answer question (Objective type).
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer eight questions. Each answer should contain four points. Each question has a weight = 1 (Short Answer type).
5. Part C contains eight questions of which the candidate has to answer five. Each question has a weight = 2. The answer must contain 8 points (Short Essay type).
6. Part D contains three questions of which the candidate has to answer two. Each question has a weight = 4. Each answer must contain 16 points (Long Essay type).
7. The total weightage for the entire questions to be answered is 30.

II. 2. END SEMESTER EVALUATION FOR LABORATORY COURSES

The components to be assessed as part of ESE of Lab courses and their weightage are discussed along with the syllabi for each of such laboratory courses in the subsequent sections.

III. Project/dissertation, Factory/R&D Institute Visit and Project based Viva-voce Evaluation of the Project & Factory/Research institution visit report Semester VI CH1646

The Project work may be conducted individually or by a group comprising of a maximum of 5 students during semester V and VI. The work of each student/group shall be guided by one faculty member. After the completion of the work, the student shall prepare 2 copies of the Project report. The copies certified by the concerned guide & the Head of the Department shall be submitted prior to the completion of the sixth semester. The typed copy of the report may have a minimum of 25 pages. It should contain Title page, Introduction, Review, Result and Discussion, References etc. These reports will be evaluated by a board of two Examiners appointed by the University. The examiners should affix their dated signatures in the facing sheet of the Project report. The evaluation/Viva voce of the Project report is conducted on a separate day. The students have to present their work individually before the examiners on the Viva-Voce day. The examiners shall consult each other and award grades based on the various components given in the Table 1 below. There shall be no continuous assessment for dissertation /project work.

The Factory/ research institution visit report should submitted during the Lab course examination/Viva voce and the report must be evaluated and the examiners should affix their dated signatures in the facing sheet. Good presentation of any one Chemical Factory/Research centre visit may be considered for A grade. Other presentations are graded accordingly into B, C, D etc. Candidate is expected to make individual report. So variety must be appreciated. Weightage for study tour report is 4.

III **EVALUATION OF THE PROJECT AND FACTORY/RESEARCH INSTITUTE VISIT (CHEMISTRY)**

No.	**Main component**	**Weight**	**Sub components**	**Grade**
1	Dissertation	4	Introduction, Review and Objectives	Excellent : A Very Good: B Good: C Average: D None: E
2	,,	4	Materials and methods	Excellent : A Very Good: B Good: C Average: D None: E
3	,,	4	Results and Discussion	Excellent : A Very Good: B Good: C Average: D None: E
4	,,	4	Conclusion and References	Excellent : A Very Good: B Good: C Average: D None: E
5	Project Presentation	5	i) Clarity and understanding ii) Effective presentation iii) Time Management iv) Interaction	All four: A Three: B Two: C One: D None: E
6	Factory/ research institution Visit	4	i) Brief Description of factory/Institute ii) Figures/flow charts iii) Details of instruments/facilities iv) Neatness of presentation	All four: A Three: B Two: C One: D None: E
	Total for Project	**25**		
7	Viva- Voce	5	Understanding of the i) Review ii) Objectives iii) Methodology iv) Results	All four: A Three: B Two: C One: D None: E
	Total for Viva-voce	**5**		

The grades for Project/dissertation shall be calculated by consolidating the grades secured for the submission of Project/dissertation and the project based via-voce, taking into account that the Project/dissertation has a weight of '3' and that of project based via-voce has a weight of '1'.

IV GENERAL ASPECTS OF COURSE AND CREDIT TRANSFER

As per Regulations, students from other institutions may be admitted in the 3rd and 5th by transfer subject to conditions prescribed by the University. Such transfers to a B. Sc. Chemistry Programme can be permitted only from a similar semester based three year degree programme with Chemistry as the major and maths as a compulsory complementary course and physics as a desirable complementary course. The requirements of the language, foundation and elective courses will be decided as per views of the concerned BoS. For core course transfers, the transferable credit per course is limited to 4 (as this is at present the highest credit per course in Univ. of Kerala) even if the source Institution awards a credit >4. If, however, a core course with comparable content, contact hours and mode of evaluation has a credit <4 at the source Institution, then the transferee may be awarded a credit in par with the similar course at this University.

V EXPERIMENT IN CHEMISTRY USING MICRO SCALE TECHNIQUE

Chemistry being an experimental science, testing the theory by doing practical has always been the method of deep understanding of the subject of chemistry.

Today, Laboratories in academic institutions consume large amounts of chemicals. The ever rising cost of chemicals is adversely affecting many of the practical exercises. The fumes and gases evolved during chemical reactions are threatening the environment. The awareness of eco-friendly experiments is thus becoming a global phenomenon.

It is in this context that a need has arisen which was never so acute here before that the laboratory chemicals are used at a minimal level without affecting the skill and understanding of a student performing the Lab sessions. The conventional methods use large scale quantities of chemicals for the experiments. The change brought about in the present scheme makes use of micro scale techniques and two burette titration in the Chemistry practicals. This has been done without any conceptual deviation of the principles of experiments in chemistry. Where quantities were used on gram scale, the new method envisages the use in milligram scale. Where volumes of solutions were used in multiples of 10 to 100, the new method prefers only few ml. scales. This reduces the expenditure on chemicals to a great extent. The apparatus are of smaller size. The scheme saves time and energy of a student while performing the experiments.

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - 1 Course Code– CH1141

Semester – I Credit-4

Inorganic Chemistry I

(2013 admission onwards)

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

Aim of the Course

The course builds on the plus-two level introductory chemistry and familiarizes the students with the theoretical aspects of atomic structure. Subsequently, it delves into the the principles of qualitative and quantitative inorganic analysis at the laboratory. The course also introduces the students an idea about environemental chemistry and different types of pollution.

Course objective

COURSE OFFERING AND CREDITS

Semester I; credits: Four

COURSE OBJECTIVES

1. To understand the structure of atomic structure and properties of elements in relation to electronic configuration .
2. To learn the principles of chemical analysis and environmental chemistry. Upon course completion, the student will be able to appreciate how the inner structure of elements dictates the chemical properties of elements. Students will acquire basic laboratory skills required for chemical analysis and become familiar with data collection, record keeping and data analysis in a chemical laboratory.

COURSE TRANSACTION FORMAT

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 lab instruction.

MODE OF EVALUATION

PART A.

Continuous Evaluation: 25% weightage, continuous during semester. CE components are (i) Attendance for lecture and laboratory components, separately; (ii) class test for lecture part and (iii) assignment / seminar for lecture part, for which grades A-E will be awarded as per Regulations for each component. There will be two class tests (for which, the better of the two grades obtained will form part of CE) and one assignment / seminar during the semester lecture part.

End Semester Evaluation: 75% weightage. End of semester University theory examination will be of 3-hr duration. Grades A-E will be awarded as per Regulations [See Regulations].

PART B.

Continuous Evaluation: CE component for Semester I is (i) Attendance.

End Semester Evaluation: End of semester University laboratory examination will be at the end of 4th semester. Grades will be awarded as per Regulations. [See Regulations].

Course outline

Module I - Atomic Structure ***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 - Charge cloud and probability concepts - orbitals, radial and angular probability distribution curves, shapes of orbitals. Particle in a one-dimensional box. eigen functions and eigen values. Particle in three dimensional box.

Module II - Electronic Configuration and Periodicity ***6 hrs.***

Quantum numbers - Pauli's exclusion Principle - aufbau Principle – Hund's rule - Electronic configuration of atoms - classification of elements into s, p, d, f blocks - atomic radii, ionization enthalpy, electron gain enthalpy and electronegativity- Pauling's scale, Mulliken and Alred - Rochow scale- ionic character - periodicity - horizontal, vertical and diagonal relationships - anomalous behaviour of the first element of a group.

Module III - Analytical Principles - I ***6 hrs.***

Inorganic qualitative analysis - Common ion effect - solubility product - principle and procedure of elimination of interfering anions - precipitation of cations. Microscale analysis – Advantages

Quantitative Analysis - Calibration and use of apparatus and weights for titration. Theory of titration - acid-base, redox, precipitation and complexometric titrations. Theory of indicators - acid-base, redox, adsorption and metallochromic indicators. Two Burette Method of titration – Principle and advantages.

Module IV - Analytical Principles – II ***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. Chromatography - classification of methods - Elementary study of adsorption, paper, thin layer, ion exchange and gas chromatographic methods.

Module V Environmental Chemistry - Air Pollution ***6 hrs.***

Environmental segments - Lithosphere, Hydrosphere, Biosphere, Atmosphere - Composition and structure of atmosphere - Troposphere, Stratosphere, Mesosphere, Thermosphere Air pollution - 3 types of classification, types of pollutants - CO, CO_2,

NO, SO_2, H_2S, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons - their source and influence - ozone layer depletion, ozone hole, protection of ozone umbrella - acid rain, green house effect, smog - management of air pollution.

Module VI - Environmental Chemistry - Water and Soil Pollution ***6 hrs.***

Water pollution: Classification of pollutants - organic, inorganic, suspended solids and sediments, radioactive materials, Heat, industrial waste, sewage water, detergents, agricultural pollutants - treatment of industrial waste water - 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) Manas Chanda, "Atomic structure and Chemical Bond including Molecular spectroscopy"
2) E.S. Gilreath "Fundamental concepts of Inorganic Chemistry"
3) Puri, Sharma and Kalia "Inorganic Chemistry"
4) Madan "Inorganic Chemistry".
5) Manku , "Theoretical principles of Inorganic Chemistry" -
6) M. C. Dey and J. Selbin "Theoretical Inorganic Chemistry".
7) F A Cotton and G. Wilkinson "Basic Inroganic Chemistry".
8) S. K. Banerji, "Environmental Chemistry".
9) A. I. Vogel, "Text book of Qualitative Analysis"
10) A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
11) Day & Underwood "Quantitative analysis: laboratory manual"
12) A. K. De "Environmental Chemistry - An introduction"
13) A. K. Srivasthava and P. C. Jain, "Chemical Analysis"
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"

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester -I Core Course-1 Course Code - CH1141
INORGANIC CHEMISTRY I

Time: Three Hours Maximum **Weightage: 30**

Section- A, Weightage 0.25 each

Answer all Questions. Answer in one word / sentence

I. Fill in the blanks

1. Splitting of spectral lines in a magnetic field is called _____
2. According to the uncertainty principle the accurate and simultaneous determination of the velocity and _____of a microscopic particle is impossible
3. Titrations involving acidified $K_2Cr_2O_7$ are examples for _____titrations.
4. Murexide is a _____indicator

II. Answer in one word

5. Quantum number which determines the orbital angular momentum of the electron
6. Ozone layer prevents _____ radiation to reach earth surface.
7. _____ is the part of the atmosphere that is ionized by solar radiation.
8. The _____ in photochemical smog is the main chemical which causes irritation to eyes, causing them to water and sting.

III. Fill in the blanks using appropriate words

9. Dissociation of acetic acid is suppressed on adding sodium acetate. This is an example for _____
10. A substance is precipitated when its _____ exceeds the solubility product.
11. In the gravimetric analysis of Nickel, _____ is the precipitating agent
12. The process of allowing the precipitate to stand for several hours in contact with the solution from which it was formed is called _____

IV. Answer in one word

13. Give the unit of dipole moment.
14. In the stratosphere, fluorine from the CFC's change to which compound.
15. Which is the group reagent/s used for 1^{st} group analysis ?
16. Name a carrier gas used in gas chromatography.

0.25×16 = 4

Section B, Weightage – 1 each (Short answer type)

Answer any 8 from the following. Each answer must contain 4 points.

17. Draw all the d orbitals.
18. Write the Schrodinger wave equation. Explain the terms.
19. State and illustrate Pauli's Exclusion Principle
20. Arrange F, Cl, Br and I in the increasing order of their electron gain enthalpy values. Give appropriate reason.
21. What is common ion effect. Give an example
22. What are the different types of titrations.
23. Describe the effect of temperature on precipitation
24. What is meant by Rf value? What is its use in chromatography?
25. Name the major pollutants in air?
26. What are the factors affecting the purity of water?

27. What is smog?
28. Distinguish between titrant and titrate**.** **1×8 =8**

Section C, Weightage – 2 each (Short essay type)

Answer any 5 from the following. Each answer must contain 8 points.

29. Explain the diagonal relationship of elements with example
30. Explain uncertainty principle clearly bringing out its physical significance.
31. Write a note on (a)metallochromic indicators. (b) elimination of phosphate anion during the analysis of cations
32. Describe briefly co-precipitation and post- precipitation.
33. Explain the source and hazards of fly ash and asbestos.
34. Explain briefly soil pollution..
35. Obtain the solution of Schrodinger wave equation of a particle in a one – dimensional box.
36. Discuss the applications of common ion effect and solubility product in quantitative analysis **2×5 = 10**

Section D, Weightage 4 each (Long essay type)

Answer any two from the following.

37. Discuss the principles involved in various chromatographic separations.
38. Write an essay on plastic waste and long term use of fertilizers
39. Explain the electronegativity in terms of Pauling, Mulliken and Alred – Rochow scales.

4×2 = 8

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME
SEMESTER - 2 CREDIT- 3

Foundation Course No. – 2 COURSE CODE- CH1221
Methodology and Perspectives of Sciences and General Informatics

(2013 admission onwards)

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 **36Hours**

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 applications in analysis and presentation of experimental data.

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.

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 – revolutions in science – science and technology - hypothesis – observations and proofs. Revision of scientific theories and laws. Importance of models, simulations and virtual testing

Design of an experiment – experimentation - observation – data collection – Documentation of experiments – Nature and types of data – typical example. interpretation and deduction – necessity of units and dimensions – repeatability and replication. Documentation of experiments – record keeping – connection between measurements and underlying theory. Types of experiments –. Choice and selection of instruments. Types of instrumentation. Accuracy and precision.

Module II- Science, Society and Various approaches of Science 6Hrs

Better understanding of Science-Science and culture, citizenship, social cohesion, work, employment, development and research- Multicultural society and Science strategies to meet challenges in twenty first century, Globalisation- Population

Knowledge transfer process- Knowledge dissemination and utilization- Process and product of Science- Acquisition of various basic process skills of Science- Problem solving method – enquiry vs discovery approach- Development of Scientific creativity - induction-deduction methods –Integration of various methods

Module III – 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 - origin of modern chemistry - 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, Dmitri Mendeleev, Michael Faraday and Marie Skłodowska-Curie. Structure of chemical science: scope of chemical science, branches of chemistry. Role of Chemistry as a central science connecting Physics, Biology and other branches of science. Basic ideas of interdisciplinary areas involving Chemistry

Module IV – Overview of Information Technology 6 Hrs

Features of the modern personal computer and peripherals – computer network and internet – overview of operating system and major application of softwares. Data information and knowledge – knowledge management – internet as a knowledge repository – academic search techniques – creating your cyber presence – open access initiation – open active publishing models – Basic concepts of IPR, copy right and patents – plagiarism – Introduction to use of IT in teaching and learning –educational softwares – INFLIBNET, NICNET, BRNET, NPTEL, VIRTUAL LABS OF MHRD – academic services.

Module V Research in Chemistry 6 Hrs

Selecting a topic – hypothesis- design of experiment: 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 using spread sheet, preparation of seminar papers, project etc. using computers. Background Reading - Selected Internet Resources in chemistry –Major Publishers in Chemical science, Author, Citation, Computer Searching, Reviews, Keywords

Module VI Introduction to Cheminformatics 6 Hrs

Basics of cheminformatics, applications of cheminformatics, storage & retrieval, file formats – MOL, SDF, CML, PDB formats, SYBYL Line Notation, SMILES of simple molecules like methane, ethyl alcohol, benzene cyclohexane etc. Structure drawing, spread sheet and chemistry related softwares. Molecular visualization tools. Chemical Databases, Chemical Safety - Toxicology Information - material safety data sheets

Reference

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. Soti Sivendra Chanthra Contemporary Science Teaching,
5. Alexis & Mathews Leon, Fundamentals and Information Technology. Leon Vikas ISBN 08125907890.
6. Ramesh Bangia, 'Learning Computer Fundamentals, Khanna Book Publishers, ISBN 818752252b
7. Barbara Wilson, Information Technology, The Basics, Thomas Learning.
8. Calvin W Tayler and Frank Barron Scientific Creativity : Its Recognition and Development,
9. Louise Cohen, Lawrence Manion & Keith Morrison A Guide to Teaching Practice,
10. Encyclopaedia of Modern Methods of Teaching and Learning, Edited V K Rao
11. Haseen Taj Current Challenges in Education,
12. Radha Mohan Research Methods in Education,
13. R T Mishra Teaching of information Technology,
14. M Ravikumar Information Technology for Higher Education,
15. Kolasani Sunil Kumar, K Ramakrishna and Digumarti Bhaskara Rao Methods of Teaching Chemistry,
16. V. Rajaram, Introduction to Information Technology , Prentice Hall.
17. Newton R G The Truth of Science : New Delhi 2nd edition.
18. Andrew R. Leach and V.J. Gillet An Introduction to Chemoinformatics
19. N.C. Datta The Story of Chemistry , University Press.
20. http://www.vlab.co.in
21. http://nptel.iitm.ac.in/

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards

Semester -II Core Course-I1 Course Code - CH1221

Methodology and Perspectives of Sciences and General Informatics

Time: Three Hours Maximum **Weightage: 30**

Section- A, Weightage 0.25 each

Answer all Questions. Answer in one word / sentence

I 1.Test data are most validly used in
(a) Determining grades
(b) Evaluating the effectiveness of instruction
(c) Diagnosing pupil difficulty
(d) Orienting instruction and expectations at the level of the child

2. Which among the following is law?
(a) F = ma (b) P α 1\V (c) dq = du + Pdv (d) V α T

3. Which among the following is the most fundamental characteristic of science?
(a) formation of hypothesis (b) measurement
(c) reproducibility of the measurement (d) experiment

4. Scientific creativity originate from
(a) imagination (b) knowledge (c) various skills (d) experiments

II 5. A provisional supposition made in order to explain scientifically some fact or phenomenon is called _____

6. _____is not a process skill in Science.

7. The one which represents deduction is _____

8. Father of modern chemistry is _____

III. 9. _____ synthesized urea in the laboratory from inorganic compounds for the first time

10. Warrantee is _____

11. The SMILES of benzene is _____

12 NPTEL in short is _____

IV 13. One application of computer in medicine is _____

14. INFLIBNET is used in _____

15. Plagiarism is _____

16. Internet is _____

Section B, Weightage 1

Answer any 8 from the following. Each answer must contain 4 points.

17. Name any four major journals in chemistry.

18. Distinguish between accuracy and precision with suitable examples.

19. Prepare a format for the documentation of the experiment to determine the hardness of a sample of water.

20. What are the basic components of the product of science?

21. Name four chemistry related softwares?

22. What are the major contributions of Marie Skłodowska-Curie?

23. What is a chemical database?

24. Explain basic concepts of IPR?
25. Explain standard deviation?
26. Explain enquiry vs discovery approach.
27. What are the features of modern personal computer?
28. Rutherfold's gold foil experiment is a milestone in the history of science. Comment

Section C , Weightage 2

Answer any 5 from the following. Each answer must contain 8 points.

29. What is meant by revision of scientific theories and laws?
30. Explain documentation of experiments.
31. What is open access initiation?
32. Explain the applications of cheminformatics
33. Explain copy right and patents.
34. Highlight the major roles played by chemistry in everyday life?
35. Exemplify the use of a pi-diagram in presenting the results of a typical experiment
36. Discuss the internet resources available for virtual learning

Section D, Weightage 4

Answer any two from the following.

37. Explain the various types of a) file formats b) databases used in cheminformatics ?
38. Explain primary, secondary and digital sources
39. Explain the various components essential for preparing a research article in chemistry.

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.

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - II Course Code– CH1341

Semester – III Credit-3

Inorganic Chemistry II

(2013 admission onwards)

54 hrs

Module-1 Chemical Bonding –I ***9hrs***

Covalent bond-valence bond theory and its limitations- hybridization - hybridization in methane, ethylene, benzene, acetylene - VSEPR theory and its applications- structure of XeF_2, XeF_4, XeF_6, ClF_3, IF_5, IF_7, NH_3,H_3O^+, SF_4 & H_2O

MO theory, LCAO of H_2^+ ion, 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, Born-Haber 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)- weak electrical forces – hydrogen bond, inter and intramolecular hydrogen bond, intermolecular interaction – induction forces and dispersion forces such as van der Waals forces, ion –dipole, dipole-dipole, ion-induced dipole, dipole-induced dipole, induced dipole-induced dipole interactions

Module III : 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, elementary idea of subatomic particles like neutrino, anti neutrino etc-applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

Module IV : Non Aqueous Solvents ***9hrs***

General properties- classification- self ionization and leveling 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: 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 (Elementary idea only): XRD, Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy(STM), Scanning Electron Microscopy(SEM), Transmission Electron Microscopy(TEM)

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. "Essentials of Nuclear Chemistry" : H. S.Arniker
6. "Non-aqueous Solvents" : Sisler
7. "Fundamentals of Inorganic Chemistry" : E. S. Gilreath
8. "Instrumental Methods of Analysis" : Willard, Merrit
9. "Inorganic Chemistry" : Shriver and Atkins
10. "Coordination Chemistry" : Bosolo and Johnson
11. "Coordination Chemistry" : S. F. A. Kettle
12. "Inorganic Chemistry" : J. E. Hueey
13 . "Nano, The Essentials", T. Pradeep, Mc Graw- Hill Education

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – III Core Course No. - II Course Code– CH1341
Inorganic Chemistry II

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 0.25 eah (Answer in one word\sentence)

Answer all questions

1. 1. Example of a weak acid is _____.
   2. Conjugate base of HF is _____.
   3. The isotope for carbon dating is _____.
   4. Hydrogen bonding in salicylaldehyde is _____molecular.

II. 5. The hybridization of chlorine in ClF_3 is _____
   6. Write n/p ratio of stable nuclei.
   7. Name a naturally occurring radioactive element.
   8. Name a radioactive element used in cancer treatment.

III. 9. Water is an example for _____solvent.
   10. The bond order of O_2^+ is_____.
   11. An aprotic non-aqueous solvent is _____ .
   12. Beer- Lambert's law is mathematically expressed as _____ .

IV. 13. Expansion for TEM is ----------.
   14. Frequency of sound waves used in sonochemistry is _____.
   15. C- 60 is known as----------.
   16. Faraday prepared _____ sols as the divided metal. **0.25×16 = 4**

Section B. Weightage I each (Short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. Explain Lowry- Bronsted theory of acids and bases.
18. What is dipole moment ?
19. What is SHAB principle?.
20. What is Geiger –Nuttal rule.
21. Explain with example artificial transmutation.
22. Define binding energy.
23. Write a note on protic and aprotic solvents.
24. Write a method for preparing Ag nano particle..
25. What is flame emission spectroscopy .
26. Ortho nitro phenol is more volatile than para nitro phenol. Why ?
27. Explain sol- gel synthesis.
28. Explain the principle of hollow cathode lamp.

1×8 = 8

Section C, Weightage 2 each (Short essay type)

Answer any five questions from the following. Each answer must contain 8 points.

29. Explain different theories of metallic bonding.
30. Distinguish between levelling solvents and differentiating solvents
31. Discuss the structure and bonding in benzene.
32. What is van der waal's force. Explain the different types of interactions.
33. How will you prepare a nano system using hydrothermal technique.
34. Write notes on various instrumental tools used for analysing nanostructures.

35. Using TG data explain the decomposition of $CaC_2O_4.H_2O$.
36. A freshly cut piece of wood gives 16100 counts of ß-ray emission per minute per kg and an old wooden bowl gives 13200 counts per minute per kg. Calculate the age of the wooden bowl. The half-life period of carbon is 5568 years.

2×5 = 10

Section D, Weightage 4 each (Long essay type)

Answer any two questions.

37. Using suitable examples illustrate how thermoanlytical technique DTA is complementary to DSC.
38. Give a comparative account of VB and MO theories using relevant examples.
39 Write a note on a) liquid ammonia b) liquid HF as non-aqueous solvents. **4×2 = 8**

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - III Course Code– CH1441

Semester – IV Credit-3

Organic Chemistry I

(2013 admission onwards)

54 hours

Lecture - Tutorial – Lab: 3-0-2

***Aim of the Course*:** The syllabus includes introduction to hybridization, 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. By studying this topics the students get an idea of the mechanism of reactions of organic compounds and sterochemical aspects

Module I: Introduction to Organic Reaction Mechanism I (9 Hrs)

Introduction to reaction mechanism, Drawing electron movements with arrows- curved arrow notation. Half headed and double headed arrows. Nature of bond fission – Homolytic and Heterolytic. Types of reagents – Electrophiles and Nucleophiles. Types and sub types of following organic reactions with definition and at least one example of each- Substitution, Addition, Elimination and Rearrangement. Reactive intermediates with examples Electron displacement effects – inductive effect, electromeric effect, hyperconjugation, resonance, steric effect., energy considerations. Reaction intermediates – carbocations, carbanions, free radicals, carbenes, benzynes. Methods of determination of reaction mechanism – product analysis, intermediates, isotope effect, kinetic and stereochemical studies.

Module II: Reaction mechanism II (9 Hrs)

Aliphatic nucleophilic substitutions, mechanism of S_N1,S_N2 and SNi reactions - effects of structure-substrate, solvent, nucleophile and leaving groups - Stereochemistry- Walden inversion, Elimination Reactions:-Hoffmann and Saytzeff rules- cis and trans eliminations –mechanisms of E1 and E2 reactions. Elimination versus substitution. Addition reactions- mechanisms of addition of Bromine and hydrogen halides to double bonds-Markownikoff's rule and peroxide effect Study of reactions of hydroboration, epoxidation, ozonolysis, hydration, cis-hydroxyaltion.

Module III: Arenes & Aromaticity (9 Hrs)

Nomenclature of benzene derivatives, Aromaticity, Huckel's rule, Nonbenzenoid aromatic compounds – 5 membered and 7 membered ring compounds structure of benzene. Mechanism of aromatic electrophilic substitution in benzene– halogenation, nitration, sulphonation, Friedel-Crafts alkylation, acylation. Energy profile diagram. Orienting effect of substituents like –OH, $-NH_2$, $-NO_2$, $-CH_3$ and halogens. Nucleophilic aromatic substitution. Elimination-addition mechanism, reactivity and orientation aromatic electrophilic substitution in naphthalene- Friedel-Crafts alkylation and acylation - nitration.

Module IV: Organic reagents and organometallic compounds (9Hrs)

Acetoaceticester-synthesis and tuatomerism-syntheic application of Acetoaceticester, Synthesis and synthetic application of Diethylmalonate. Grignard reagents, organic zinc reagents, Reformatsky reaction.

Module V: Stereochemistry-I

Stereoisomerism - definition - classification into optical and geometrical isomerism Projection formulae - Fischer, flying wedge, sawhorse and Newman projection formulae - notation of optical isomers -D-L notation- Cahn-Ingold-Prelog rules - R-S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations. Optical isomerism - optical activity - optical and specific rotations - conditions for optical activity - asymmetric centre -- chirality - achiral molecules - meaning of (+) and (-) Elements of symmetry -. Racemisation - methods of racemisation - Resolution - methods of resolution (chemical- conversion to diastereoisomers, biochemical and chiral chromatography) - Asymmetric synthesis –asymmetric catalysis-BINAP for the synthesis of naproxen. Steroisomerism in the real world-pthalidomide, chiral drugs.

Module VI: Stereochemistry-II

Optical activity in compounds not containing asymmetric carbon atoms- Biphenyls, 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, dipole moment, dehydration and cyclisation Conformational analysis - introduction of terms - conformers, configuration, dihedral angle, torsional strain - Conformational analysis of ethane and n-butane including energy diagrams - conformers of cyclohexane (chair, boat and skew boat forms) - axial and equatorial, Bonds-ring flipping showing axial equatorial interconversions, conformation of methyl cyclohexane.

References

1. I L Finar, “Organic Chemistry - Vol. I”, Longman
2. M K Jain, “Principles of Organic Chemistry”,
3. Morrison & Boyd, “Organic Chemistry”, Prentice Hall
4. Peter Sykes, “A Guide book to Mechanisms in Organic Chemistry”, Longman
5. Jerry March, “Advanced Organic Chemistry”, Wiley
6. Bahl&Bahl, “Advanced Organic Chemistry”
7. Tewari&Mahrotra, “A text book of Organic Chemistry”
8. P L Soni, “Organic Chemistry”
9. Rein hard Bruckner, “Advanced Organic Chemistry Reaction Mechanisms”
10. Arun Parikh, Hansa Parikh, Khyati Parikh, “Name Reactions in Organic Synthesis”.
11. Ernest L. Eliel, Samuel H. Wilen “Stereochemistry of Organic Compounds”

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – IV Core Course No. - III Course Code– CH1441
Organic Chemistry I

Time: Three Hours **Maximum Weightage : 30**

Section-A, Weightage 1

Answer all questions. Answer in one word\sentence.

I. 1. The type of reaction involved in the reaction of bromine with ethene is_____
2. The electrophile in the nitration of benzene is_____
3. The intermediate in the $S_N1$mechanism is_____
4. A reagent used for cis hydroxylation of alkene is_____

II. 5. Which catalyst used for Friedel Crafts acylation?
6. Name of a non benzenoid aromatic compound.
7. What is the general formula of Grignard reagent.
8. Ethylacetoacetate is prepared from ethyl acetate by _____ reaction.

III. 9. Which isomer of naproxen has more analgesic action.
10. Cis-but-2-ene and Trans-but-2-ene are _____ type of isomers.
11. An organic reaction which condenses aldehydes (or ketones), with α-halo esters, using metallic zinc to form β-hydroxy-esters is called _____
12. Write an example of non-benzenoid aromatic compound.

IV. 13. Complete the equation $RCOCl \xrightarrow[H2]{Pd\BaSO4} \rightarrow$ ----------

14. Complete the equation $C_6H_6 + C_6H_5CH_2Cl \xrightarrow{AlCl3} \rightarrow$ ----------

15. Identify X Glycerol + Oxalic acid $\xrightarrow{110^\circ C} X$

16. Phenol_ _ $\xrightarrow{CHCl3+KOH}$ _____ →

Section – B (Short answer type)

Answer any 8 questions, Weightage- 1

17. Indicate the type of hybridization of carbon atom in the following compounds.
(a) CH_3Br (b) CH_3OH (c) HCN (d) HCHO
18. Phenol is acidic while ethanol is not. Why?
19. Arrange the following in the increasing order of stability.
$(CH_3)_2CH^+$, CH_3^+, $(C_6H_5)_2CH^+$, $C_6H_5\text{-}CH_2^+$
20. Give an example and state Hofmann's rule.
21. What is Kharasch effect? Illustrate with an example.
22. When toluene is nitrated the major products are ortho and para substituted products. Why?
23. Write briefly the mechanism of nitration of benzene.
24. Define Huckel's rule.
25 Predict the products obtained on the nitration of
(1) 1,2-dibromo benzene (2) 1,3-dibromo benzene

26. Distinguish between aldehydes and ketones.
27. How will you convert ethylene to ethylene glycol?
28. Write a note on aldol condensation.

Section C (Short essay type)

Answer any 5 questions. Weightage-2

29. Give an account of the stability of carbocations.
30. Halogens are electron withdrawing yet they direct the incoming electrophile to ortho-para positions. Why?
31. Compare SN^1 reaction rates and SN^2 reaction rates of methyl, ethyl, iso-propyl and t-butyl halides.
32. Write briefly on the mechanism and orientation of aromatic nucleophilic substitution reactions proceeding through benzyne intermediates.
33. Give a detailed account of the role of group already present in the aryl ring in directing the incoming group in an electrophilic substitution reaction.
34. Discuss the molecular orbital structure of Benzene.
35. Discuss the mechanism of addition polymerization initiated by free radicals.
36. Write a note on aromatic electrophilic substitution.

Section –D (Long essay type)

Answer two questions. Weightage-4

37. (a) How is vanillin prepared ? What are its uses?
    (b) Write a note on absolute alcohol and power alcohol.
    (c) What are the products formed on nitration of the following compounds.
    Phenol, chlorobenzene, nitrobenzene and benzoic acid.
    (d) Write a note on Wolf- Kishner reduction and Clemmenson reduction.
38. Give a detailed account of the generation, structure and stability of free radicals, carbanions and singlet and triplet carbenes.
39. Explain the mechanism of E_1 and E_2 eliminations.

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - V Course Code– CH1541

Semester – V Credit-4

Physical Chemistry I

(2013 admission onwards)

54 hours

Aim: This course is an introduction to different states of matter and provide 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, Collision frequency, Collision number, Collision diameter and mean free path

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 most probable velocity, Derivation of root mean square, most probable and average velocities from the equation.

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

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 crystallography, 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, radius ratio effect and coordination number, limitations of Radius ratio rule-Imperfections in crystals, point defects – Schottky and Frenkel defects, Non-stoichiometric defects.

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

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, 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)***

Basic concepts- system, surroundings, types of systems. Extensive and intensive properties, macroscopic properties. State functions and path functions. 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 for 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.

Module V – Thermodynamics II ***(9 hrs)***

Need for IInd law. Different statements of IInd 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 criteria 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 change on temperature, volume and pressure. Maxwell's relations. Partial molar quantities- Chemical potential-Gibbs-Duhem equation. Concept of fugacity, determination of fugacity by graphical method.

Module VI – Group theory & Liquid crystals ***(9 hrs)***

Group theory: Elements of symmetry – Proper and improper axis of symmetry, plane of symmetry, centre of symmetry and identity element. Combination of symmetry elements, Point groups, C_2V, C_3V and D_3h, Group multiplication table of C_2V, Determination of point groups of simple molecules like H_2O, NH_3 and BF_3.

Liquid crystals: Types of liquid crystals – smectic, nematic and cholesteric, Swarm theory of liquid crystals, uses of liquid crystals.

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

7. R.Stephen Berry,Stuart A.Rice,John Ross,"Physical Chemistry,2nd edition,Oxford".
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
11. N B Hannay, " Solid State Chemistry", Prentice Hall
12. Anthony R West, " Solid State Chemistry and its Applications", Wiley Eastern
13. V Ramakrishnan and M S Gopinathan, "Group Theory in Chemistry",Vishal Publishing Co.
14. A. Salahuddin Kunju and G. Krishnan **"**Group Theory and its Applications in Chemistry"

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – V Core Course No. - V Course Code– CH1541
Physical Chemistry I

Time: Three Hours **Maximum Weightage : 30**

Section A. Weightage- 0.25 eah (answer in a word\sentence)

Answer all questions

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

2. NH_3 belongs to_____ point group.

3. The temperature at which the second virial coefficient of a real gas is zero is called_____

4. The van der Waal's equation for n moles of a gas is_____

II. 5. Total number of Bravais lattices in a crystal is _____

6. NaCl has F.C.C. structure. The number of Na^+ and Cl^- ions in the unit cell is _____

7. Efficiency of Carnot engine working between temperatures T_1 and T_2 is_____

8. The total number of space groups in a crystal is _____

III. 9. The unit of surface tension of a liquid is _____

10. Give an example of a liquid crystalline substance.

11. Isotonic solutions must have the same _____

12. The van't Hoff equation for osmotic pressure of a dilute solution is _____

IV 13. Work done in a reversible process is _____

14. Gibb's free energy relation is _____

15. The temperature at which the Joule- Thomson coefficient changes sign is known as _____

16. For a cyclic process ΔE =_____

0.25×16 = 4

Section B. Weightage-1 each (short answer type)

Answer any 8 from the following. Each answer must contain 4 points.

17. What is the law of rationality of indices?
18. What is Poisuellie's equation?
19. Explain van't Hoff factor
20. Explain first law of thermodynamics.
21. Derive the expression for Joule Thomson coefficient
22. Explain any two statements of second law of thermodynamics.
23. Explain the physical significance of entropy
24. What are the proper and improper axes of symmetry?
25. Draw the group multiplication table of C_{2v} point group
26. Define the terms collision frequency and collision number.
27. Explain virial equation of state.
28. Explain elements of symmetry of crystals. **1×8 = 8**

Section C. Weightage 2 each (short essay type)

(Answer any 5 from the following) Each answer must contain 8 points.

29. Derive root mean square velocity and average velocity from Maxwell- Boltzmann equation.

30. An aqueous solution containing 0.25 g of a solute dissolved in 20 g of water froze at – 0.42 ^{o}C. Calculate the molar mass of the solute. Molar heat of fusion of ice at 0^{o} C is 6.025 KJ and R = 8.314 JK $^{-1}$ mol $^{-1}$

31. What are Rast's method and cooling curve method of determining molar mass?

32 . Explain Hess's law and its applications

33. Explain Gibbs - Helmholtz equation and its significance

34. Explain Swarm theory of liquid crystals. Mention two applications of liquid crystals.

35. What is chemical potential and derive Gibbs Duhem equation?

36. How will you experimentally determine the critical constants of a gas?. **2×5 = 10**

Section D. Weightage-4 each (long essay type)

(Answer any two from the following)

37. Explain Linde's and Claude's method of liquefaction of gases.

38. Derive Bragg's equation. The density of LiF is 2.601 g cm^{-3} . The (111) first order reflection in the X-ray diffraction from LiF occurs at 8 44 , when X-rays of wavelength 70.8pm are used. If there are four LiF molecules per unit cell, calculate Avogadro number.

39. What is Kirchoff`s equation? The enthalpy of reaction for the formation of ammonia according to reaction $N_2 + 3H_2 \rightarrow 2NH_3$ at 25 ^{o}C was found to be -91.94 kJ mol^{-1}. What will be the enthalpy of reaction at 50^{o} C ? The molar heat capacities at constant pressure and at 27^{o}C for Nitrogen, Hydrogen, Ammonia are 28.45, 28.32 and 37.07 joules mol^{-1} respectively. **4×2 = 8**

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - VI Course Code– CH1542

Semester – V Credit-4

Inorganic Chemistry III

(2013 admission onwards)

72 hrs

Aim

To improve the level of understanding of the chemistry of transition, non-transition and inner transition metals, coordination compounds, organometallic compounds, metal carbonyls and bioinorganic chemistry.

Objectives

Students, upon completion of this course, will gain exposure in the areas of the chemistry of d and f block elements. They will get an overview of the various theories of coordination compounds and isomerism in metal complexes. Another objective is to impart the student the classification, properties and applications of organometallic compounds and to make the student understand the role of metals in biological systems.

Module I Transition and inner transition elements (18 hrs)

(a) Transition elements : Electronic configuration and general characteristics - Comparison of 3d, 4d and 5d transition series – Colour, catalytic activities and spectral properties with reference to d^1 to d^{10} systems. Preparation, properties and uses of $K_2Cr_2O_7$, $KMnO_4$ and $TiCl_4$.

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

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

Module II Coordination Chemistry (18 hrs)

Nomenclature – 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 and Td complexes, Effect of crystal field splitting – factors affecting crystal field - CFSE – Spectrochemical series - M.O.Theory – Magnetic properties and colour of metal complexes – Application of coordination compounds in quantitative and qualitative analysis.

Module III Organometallic Compounds and Bioinorganic Chemistry (18hrs)

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 of iron and nickel – Bonding in organometallic compounds like ferrocene, dibenzene chromium, Ziese's salt – Dinitrogen complexes – Application of organometallic compounds.

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) – Photosynthesis – Sodium-Potassium pump - Biochemistry of magnesium and calcium (brief study only)

Module IV Compounds of non-transition elements (18 hrs)

Manufacture and uses of the following Glass – different types of glasses, Silicates, Zeolites and Silicones .

Inorganic Polymers : Phosphorus, boron and silicon based polymers – Structure and industrial applications. Borax - boron hydrides, boron nitrides, borazole and carboranes. Oxides and oxyacids of phosphorus. Oxides and oxyacids of halogens (structure only) – Inter halogen compounds and pseudo halogens – Compounds of noble gases – Uses of noble gases. Refractory carbides, nitrides, salt-like carbides, borides, and silicides

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. Organometallic chemistry : R. C. Mehrothra and A. Singh

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – V Core Course No. - VI Course Code– CH1542
Inorganic Chemistry III

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 0.25 each (answer in a word\sentence)

Answer all questions

I. 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 SO_2 to SO_3 in contact process?
4. Name the element obtained by the bombardment of ^{238}U with an a α particle.

II. 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.

III. 9. Write the structure of ferrocene.
10. Give the formula of a metal carbonyl which does not obey 18-electron rule.
11. Name the metal ion, other than magnesium, involved in photosynthesis.
12. Name a protein, containing calcium.

IV. 13. Give an example of phosphorus based polymer.
14. What is 'inorganic graphite?
15. What is the oxidation number of P in H_3PO_4?
16. Give the formula of a methanide. **0.25×16 = 4**

Section B (short answer type)

(Answer any 8 questions from the following, Each answer must contain 4 points. Weightage 1 each)

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. What is chelate effect ?
21. What is an ambidentate ligand ? Give example.
22. Explain geometrical isomerism in metal complexes with suitable example.
23. What is Ziese's salt ? Give its structure.
24. State and explain 18-electron rule.
25. How haemoglobin differ from myoglobin.
26. What are carboranes ?
27. What are zeolites ? Mention their uses.
28. What happens when orthophosphoric acid is heated ? **1×8 = 8**

Section C (Short essay type)

(Answer any 5 questions from the following. Each answer must contain 8 points. Weightage 2)

29. Starting from pyrolusite, how $KMnO_4$ is prepared ?
30. What is lanthanide contraction ? Explain its consequences .
31. What are the factors that affect stability of metal complexes ?

32. Give an account of the applications of coordination compounds in quantitative and qualitative analysis.
33. Discuss the nature of bonding in metal carbonyls.
34. Give an account of sodium-potassium pump in biological systems.
35. How silicones are prepared ? Discuss their structure and uses.
36. Compare the properties of borazole with those of benzene . **2×5 = 10**

Section D (long essay type)

(Answer any 2 questions from the following. Weightage 4 each)

37. Describe the ion exchange method for the separation of lanthanides from monazite. Comment on the magnetic properties of lanthanides.
38. Describe the splitting of d-orbitals in tetrahedral and octahedral fields according to crystal field theory.
39. Give an account of the preparation, properties, structure and bonding of noble gas compounds. **4×2 = 8**

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - VII Course Code– CH1543

Semester – V Credit-4

Physical Chemistry II

(2013 admission onwards)

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 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

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: Types of solutions – true, colloid and suspensions, 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. 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 Langmuir 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 – I ***12 hrs***

Regions of electromagnetic spectrum. Different units of energy (erg, joule, calorie, cm^{-1}, Hz, $\overset{0}{A}$ 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, effect of isotopic substitution.

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 dissociation and pre-dissociation. 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.

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.

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, Dopole 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 parachor.

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 A Alberty, “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

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – V Core Course No. - VII Course Code– CH1543
Physical Chemistry II

Time: Three Hours **Maximum Weightage : 30**

Section A , weightage 0.25 each (answer in one word\ sentence)

(Answer all questions)

I. 1. The migration of colloidal particles under the influence of an electric field is called _____

2. Entropy of CO at absolute zero is _____

3. The blue colour of water in the sea is due to _____

4. Entropy related to probability as _____.

II. 5. The Heisenberg uncertainty principle can be stated by the equation _____

6. The Laplacian operator is defined by? ^{2}= _____

7. Which of the following will give pure rotational spectrum? H_2, N_2, CO_2, HCl.

8. The minimum frequency of incident light needed to eject electrons from the surface of the metal is called _____

III.9. Schrodinger wave equation is _____.

10. Give the expression for Freundlich adsorption isotherm.

11. The compound used as standard in nmr spectroscopy is _____.

12. Give the relation between character and surface tension of a liquid.

IV. 13. Free radicals are identified using _____ spectroscopy.

14. STM is _____.

15. _____ is the unit of dipole moment.

16. The selection rule for rotational spectroscopy is _____ **0.25×16 = 4**

Section B, weightage-1 each (short answer type)

Answer any 8 questions from the following. Each answer must contain 4 points.

17. What is sedimentation?
18. Explain blackbody radiation
19. What are the postulates of quantum mechanics?
20. What is energy expression for vibrational spectrum? Explain the terms
21. Give a method for the determination of absolute entropy of a gas.
22. Explain chemical shift
23. What is hyperfine splitting in esr?
24. What are the applications of mass spectrometry?
25. How is magnetic susceptibility measured?
26. What is zeta potential ?
27. Calculate the number of fundamental modes of vibrations of CO_2 and SO_2 molecules.
28. How does stokes and anti stokes lines originate in Raman spectrum. **1×8 = 8**

Section C, Weightage 2 each (Short essay type)

Answer any 5 from the following. Each answer must contain 8 points.

29. What is an ensemble, explain the different types of ensembles.
30. Explain Frank-Condon principle.
31. Apply quantum mechanics to particle in a one dimensional box.

32. Explain mutual exclusion rule with examples.
33. Explain the spin-spin coupling and high resolution spectra in nmr with an examble.
34. What is Debye equation ? Explain its significance.
35. What are the consequences of unharmonicity in vibrational spectroscopy?
36. The fundamental vibrational frequency of carbon monoxide molecule is 2170. cm^{-1} Calculate the force constant of the molecule. **2×5 = 10**

Section D, Weightage-4 each (Long essay type)
Answer any two from the following

37. What are thermodynamic functions in terms of partition functions?
38. Derive Langmuir adsorption isotherm and explain the determination of surface area of a solid by it.
39. How is bond length determined by rotational spectroscopy?
The pure rotational spectrum of a gaseous molecule CN consists of a series of equally spaced lines separated by $3.7978 cm^{-1}$. Calculate the internuclear distance of the molecule. The molar masses are; ^{12}C=12.011 and ^{14}N=14.007 g mol^{-1}

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - X Course Code– CH1641

Semester – VI Credit-4

Organic Chemistry II

(2013 admission onwards)

54 Hrs

Lecture - Tutorial- Lab : 3-0-2

Aim of the Course : The syllabus deals with organic compounds like alcohols, aldehydes ketones, ethers, acids, carbohydrates, aminoacids, proteins, nucleic acids, oils, fats, detergents, vitamins, terpenes, alkaloids, hormones and enzymes 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 s and of organic compound

Module I Alcohols ,Ethers and Phenols ***(9 hrs)***

Preparation and properties, Zeisels method, Brief study of crown ethers and epoxides

Monohydric alcohols: Classification, physical properties–hydrogen bonding-distinction between primary ,secondary and tertiary alcohols- Ascent and decent in alcohol series Dihydric alcohols: Oxidative cleavage – Lead tetra acetate, Periodic acid- Pinacol - Pinacolone rearrangement –mechanism,

Phenols – Acidity of phenols- effects of substituents – comparison of acidity with alcohols, Preparation and uses of nitrophenols, picric acid, catechol, resorcinol and quinol Mechanisms of Reimer –Tiemann reaction, , Fries rearrangement

Module.II Aldehydes and Ketones ***(9 hrs)***

Structure and reactivity of the carbonyl group - acidity of alpha hydrogen. Comparative studies of -aldehydes and ketones,Reimer-Tiemann(mechanism) - aliphatic and aromatic aldehydes - formaldehyde and acetaldehyde-Mechanism of nucleophilic additions to carbonyl groups with mechanism on Claisen , Benzoin, Aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction(mechanism). Mannich reaction.-Addition of Grignard reagents. Oxidation and reduction of aldehydes and ketones - Baeyer-Villiger oxidation-Cannizzaro's reaction(mechanism), Meerwein-Pondorof Verley reduction, Clemmensen, Wolff-Kishner, LiAIH4 and NaBH4 reductions (mechanisms expected) .Use of acetal as protecting group, Beckmann rearrangement(mechanism)

Module.III Ethers, Carboxylic acids and their derivatives ***(9Hrs.)***

Carboxylic acids and their derivatives: - Preparation and properties of aliphatic and aromatic carboxylic acids. Ascent and descent series in aliphatic carboxylic acids. Effect of substituents on acidity of aliphatic and aromatic carboxylic acids. Preparation, properties and uses of anthranilic acid, cinnamic acid, lactic acid, salicylic acid, adipic acid, acid anhydrides, amides, esters, coumarin, malic acid, tartaric acid and citric acid.

Module IV Carbohydrates ***(9 hrs.)***

Classification and Nomenclature of monosaccharides. Configuration of monosaccharides. Preparation, properties and structural elucidation of glucose, fructose

and sucrose. Anomers, epimers and mutarotation. Mechanisms of Epimerization and Mutarotation.Ascent and descent series in aldoses and ketoses. Conversion of aldoses to ketoses and ketoses to aldoses. Conversion of glucose to mannose. Polysaccharides: - Starch and Cellulose - Preparation, properties and structure of starch and cellulose (structural elucidation not expected).

Module V Amino acids, Proteins and Nucleic acids (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, Solid Phase Peptide Synthesis). Proteins: - Structure of proteins, denaturation and colour reactions. Nucleic acids: - Classification and structure of DNA and RNA. Replication of DNA, Genetic Codes.

Module VI 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 and structure (structures of vitamin A, B1 and C but no structural elucidation). Chemistry of vision.

References

1 Morrison &Boyd,“Organic Chemistry”. :
2 F. Carey, McGrawHill,“Organic Chemistry”. :
3 I.L. Finar, “Organic Chemistry”, Vol I & II Longmann.
4 L.G. Wade, “Organic Chemistry”.
5 P.Y. Bruice,“Organic Chemistry”.
6 Stanley, H. Pine, McGrawHill,“Organic Chemistry”.
7 Jerry March,“Advanced Organic Chemistry”.
8 S.M. Mukherji and S.P. Singh, “ Reaction Mechanism in Organic Chemistry” Mac Millan.
9. Rein hard Bruckner ,“Advanced Organic Chemistry Reaction Mechanism”.
10 Bahl&Bahl,“ Advanced Organic Chemistry”.
11 Tewari, Mehrotra,“ A text book of Organic Chemistry”.
12 M.K. Jain ,“Principles of Organic Chemistry”.
13 Fieser&Fieser,“ Advanced Organic Chemistry”.
14 D. Nasipuri, “Stereo Chemistry of Organic compounds” Wiley Eastern.
15 Arun Parikh, Hansa Parikh, KhyatiParikh ,“Name Reactions in Organic Synthesis”.

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards

Semester – VI Core Course No. - X Course Code– CH1641

Organic Chemistry II

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 1(answer in a word\sentence)

Answer all questions

I 1. What is the product formed when alkyl halide is treated with sodium ethoxide?
2. The reagent used for the oxidative cleavage of 1,2-diols is_____
3. In Victor Meyer's test blue colour is shown by _____ alcohol.
4. Write the product formed when acetic acid is treated with Cl_2 in presence of red phosphorous.

II 5. In Gattermann's reaction, which is used as the catalyst _____.
6. What is chemical name of Urotropin.
7. What is picric acid?
8. What is the structure of Carbobenzyloxy Chloride.

III 9. The specific rotation of β D glucose is _____
10. Sucrose on hydrolysis gives_____
11. Linear polymer of glucose units present in starch is known as _____
12. Guncotton is _____.

IV. 13. What is the basic unit of protein?
14. Write the structure of a optically inactive amino acid.
15. Which vitamin is known as Ascorbic acid?
16. Give the name of any one plant alkaloid.

Section B, Weightage 1(short answer type)

Answer any 8

17. How can you prepare Nylon 6,6.
18. Write a short note on industrial application of cellulose.
19. What is meant by mutarotation.
20. What are the differences between RNA and DNA?
21. Write a short note on zwitter ion property of amino acids..
22. What is Canizarro's reaction?
23. Define saponification value and iodine value.
24. What is clemmenson reduction?
25. Write a short note on MPV reduction.
26. What are essential oils? Give an example.
27. What is meant by isoelectric point?
28. Draw the structure of vitamins C.

Section C, Weightage 2 (Short essay type)

[Answer any 5 questions]

29. How can you convert CH_3Cl to α-hydroxy acetic acid?
30. Write a note on benzoin condensation with the help of its mechanism?
31. How can you convert arabinose to glucose?
32. Write a note on Strecker synthesis at amino acid?

33. Discuss the importance of Quinine, Morphine and Codeine?
34. Write a short note pinacol-pinacol rearrangement.
35. Distiguish between anomers and epimers.
36. Explain SPPS

Section D, weightage 4(long essay type)
[Answer any two questions]

37. (1) What is Coumarin ? How can you prepare that ? What are its uses?
(2) How can you prepare Salicylic cid by (i) Riemer- Tiemann and (ii) Kolbe's reactions?How is it converted to Aspirin.
38. i. What is the product firmed when glucose is treated with excess of phenyl hydrazine? Write the mechanism.
ii. What are the functions of DNA and RNA
39. i. Discuss the mechanism of reduction with Lithium aluminium hydride and sodium borohydride.
ii. What are the differences between the above two reducing agents

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - XI Course Code– CH1642

Semester – VI Credit-4

Organic Chemistry III

(2013 admission onwards)

72 Hrs

Lecture- Tutorial- Lab : 4-0-2

Aim of the Course; To make the students aware of the synthesis of organic compounds and the preparation and properties of organic sulphur and nitrogen compounds, types of polymers, their synthesis and applications and the important organic spectroscopy.

Objective of the Course : By studying this part the students get an idea of polymerization and organic spectroscopy.

Module –I Polymers hrs

Polymers- Types of polymerization- addition, condensation and coordination polymerization. Zieglar –Natta catalyst. Synthesis and applications of urea – formaldehyde resins, Bakelite, polythene, PVC, PMMA, Nylon-6,6. Natural and synthetic resins. Buna-N , Buna-S, Neoprene, Polystyrene. Biodegradable polymers- two examples- starch and cellulose. Number average molecular weight and weight average molecular weight of polymers. Composites(refer any two) Dyes- Theory of colour and constitution, classification of dyes, synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo.

Module –II Organic Sulphur and Nitrogen compounds 18 Hrs

Aromatic sulfur compounds –Preparation and applications of benzene sulphonic acids, toluene sulphonic acid, benzene sulphonyl chloride, sulphanilic acid , sulphanilamide and sulpha drugs- sulphapyridine, sulphathiazole, sulphadiazine, sulphaguanidine and sulphaacetamide. synthetic detergents and detergent action, alkyl and aryl sulphonates. Organic Nitrogen Compounds Nitro compounds- preparation of nitroalkanes and nitroarenes, tautomerism, reduction of nitrobenzene in acid , base and neutral medium. General methods of preparation and reactions of aliphatic and aromatic amines, sandmeyars reaction classification of amines, separation of mixture of amines, methods to distinguish primary, secondary and tertiary amines, basicity of amines, effect of substituents , quarternary ammonium compounds- Hofmann elimination. Diazonium and diazocompoundspreparation, structure and their synthetic importance.Benzidine rearrangement.

Module III- Heterocyclic compounds and Drugs- 18 Hrs

Introduction, classification of heterocyclic compounds, nomenclature, aromaticity, preparation and properties of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline, pyramidine, purine and indole. Structural elucidation of pyrrole, pyridine and indole. Mechanism of electrophilic substitution in indole, quinoline and isoquinoline. Importance of heterocyclic compounds in medicine and biochemistry. Classification of Drugs. Classification of various types of drugs with examples. Rational. drug design and synthesis, salicylic acid and its derivatives, Ibuprofen. Principles of green chemistry.

ModuleIV – Organic Spectroscopy ***18 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.

IR Spectroscopy- molecular vibrations, factors influencing vibrational frequencies, inductive effect and hydrogen bonding. Finger print region and interpretation of IR spectra of simple organic molecules such as phenol, acetone, acetanilide, benzaldehyde.

NMR spectroscopy- 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 ethylbromide, pure ethanol and impure ethanol(acidic impurities), acetaldehyde and toluene.

Basic knowledge of ^{13}C NMR. Theory of Mass spectrometry- mass spectrum, base peak and molecular ion peak, types of fragmentation, Mclafferty rearrangement, isotopic effect. Applications- determination of molecular mass.

References :

1. Bahl & Bahl ,“Advanced Organic Chemistry”.
2. Tewari & Mehrotra ,“Advanced Organic Chemistry”.
3. M K Jain,“Principles of Organic Chemistry”.
4. Fieser & Fieser “Advanced Organic Chemistry”.
5. Jerry March,“Advanced Organic Chemistry”.
6. Morrison & Boyd ,“Organic Chemistry”.
7. I L Finar ,“Organic Chemistry” Vol I & II.
8. L G Wade,“ Organic Chemistry”.
9. S M Mukherji & S P Singh ,“Reactions , Mechanisms of Organic Chemistry”.
10. Peter Sykes ,“Organic Chemistry”.
11. William Kemp “Organic spectroscopy”
12. P S Kalsi “Spectroscopy of Organic Compounds”
13. Fred W. Billmeyer “Textbook of polymer chemistry”
14. V R Gowariker, N V Viswanathan, Jayadev Sreedhar “Polymer Science”
15. Jones, Norton & Norton “Organic Chemistry”

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – VI Core Course No. - XI Course Code– CH1642
Organic Chemistry III

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 1
Answer all questions in one word\sentence

I. 1. Name an addition polymer.
2. Give an example for an acid dye.
3. Complete the reaction $C_6H_5Br + NaNH_2 \xrightarrow{\text{liq } NH_3}$?
4. Name the standard used in ^{1}H NMR

II. 5. Which is more basic triethylamine or N,N- Dimethylamine?
6. Give an example for sulfadrugs which cures dysentery
7. Name the starting material\ reagent of Benzidine rearrangement
8. Draw the structure of isoquinoline.

III. 9. Name the products obtained in the following reaction
$CH_3CHO + CH_2N_2 \rightarrow$?
10. Give a use of phenylhydrazine reagent
11. What is the type of electronic transition possible in saturated compounds?
12. What is the monomer of natural rubber?

IV. 13. Which substance is used as the internal standard in NMR?
14. What is the product obtained on treating diazonium compound with steam?
15. What is the radiation used in NMR spectroscopy?
16. Name the monomer used in the preparation of Nylon-6.

Section-B, Weightage 1 (Short answer type)
Answer any 8

17. Describe Gabriel Phthalimide synthesis of amines.
18. Which is more basic aniline or ethylamine. Account for this
19. Give a method of preparation of sulphanilic acid
20. Give the structure of (1) Congo red (2) Fluorescein
21. Write two examples of biodegradable polymers. What are their monomers?
22. What is meant by an addition polymer ? Give an example
23. Give examples for (a) direct dye (b) mordant dye
24. What is finger print region in IR ?
25. Explain the ^{1}H NMR spectrum of butan-2-one ?
26. Explain chromophore and auxochrome with examples.
27. What are basic peaks and molecular ion peaks.
28. Explain the laws of absorption in UV spectroscopy.

Section C, Weightage 2(short essay type)
Answer any 5 questions.

29. How many proton signals would be expected in the NMR spectrum of pure ethanol ? Indicate the multiplicity of peaks.
30. Describe skraup synthesis of quinoline.
31. Give an account of Ziegler- Natta polymerization.
32. What is Mclafferty rearrangement ?

33. Explain Hoffmann elimination reaction with an example.
34. Explain the synthesis of methyl orange.
35. How will conjugation affect the UV spectrum?
36. Explain Shielding and deshielding effect in NMR spectra.

Section D, Weightage 4 (Long essay type)

Answer any two questions.

37. (a) Give the mechanisms of Cannizzaro reaction, Perkin reaction and Benzidine rearrangement.
    (b) What are dyes ? How are they classified ?
38. (a) What is diazotization ? How is benzene diazonium chloride prepared ? Discuss any four reactions.
    (b) (i) What are sulfa drugs ? (ii) Describe azo coupling . (iii) What are the applications of sulpha pyridine and sulpha diazine ?
39. (a)What are the factors affecting chemical shift ? (b) Explain the mechanism of chlorination and nitration in Indole.

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Core Course No. - XII Course Code– CH1643

Semester – VI Credit-4

Physical Chemistry III

(2013 admission onwards)

72 hrs

Aim

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 and two component systems and elementary ideas of photochemistry.

Unit I: Chemical Kinetics *12 hrs*

Order of reaction, Derivation of integrated rate equation of zero, first, second and third order reactions, 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. Kinetics of complex reactions:- Derivation of rate equation of (a) opposing reactions when both forward and backward reactions are of first order (b) first order consecutive reactions (c) parallel reactions forming two products with first order rate process, 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, collision theory of unimolecular reactions, Lindemann mechanism, steady state approximation, Theory of absolute reaction rate.

Unit 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, Reaction isotherm, Temperature dependence of equilibrium constant , Pressure dependence of equilibrium constant, Clausius-clapeyron equations and its applications.

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 indicator methods, buffer action, Henderson's equation , 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

Unit 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:- $FeC1_3$-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.

Unit IV: Binary liquid systems & catalysis ***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, Theory of steam distillation, distribution law, its thermodynamic derivation, limitations of distribution law, application of distribution law to the study of association and dissociation of molecules, solvent extraction.

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

Unit V: Electromotive force ***12 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, Fuel cells :- Hydrogen-Oxygen fuel cell, Hydrocarbon – Oxygen fuel cell.

Redox electrodes and redox systems, formal redox potential, principle of redox indicators, 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.

Unit VI: Electrical conductance & Photochemistry ***12 hrs***

Inter ionic attraction theory, Debye-Huckel-Onsager equation (Qualitative treatment only) activity and activity co-efficient 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.

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.

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.Stephen Berry,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

University of Kerala
Model Question Paper of B.Sc. Chemistry Programme
2013 onwards
Semester – VI Core Course No. - XII Course Code– CH1643
Physical Chemistry III

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage0.25 eah

(Answer all questions in a word or sentence.)

I 1. For the chemical reaction aA + bB Products, the rate constant of reaction is found to be $k = [A]^l [B]^m$. The order of the reaction is_____

2. Represent the electrochemical cell formed when Zn electrode is coupled with Ag electrode.

3. Give the Arrhenius equation.

4. Write the integrated rate equation for a first order reaction.

II 5. Write Debye- Huckel- Onsagar equation.

6. Give the relation between hydrolytic constant, dissociation constant and ionic product of water of a salt of strong acid and weak base.

7. The solubility of AgCl in water at 25^0C is 0.00179 g/L. Its solubility product at 25^0C is. _____

8. The pK_a values of four acids are given below. Arrange them in the increasing order of their acidity

Carboxylic acid	**pK_a Value**
CH_3COOH	4.80
$ClCH_2COOH$	2.86
$(CH_3)_3CCOOH$	5.05
CH_3OCH_2COOH	3.53

III 9. The expression for quantum yield of a photochemical reaction is _____.

10. The eutectic composition of Pb – Ag system is_____

11. _____ is an efflorescent substance.

12. Write the reduced phase rule equation.

IV. 13. Fractional distillation of an aqueous solution of ethanol does not give absolute alcohol, because it is

(i) an ideal solution (ii) a minimum boiling azeotrope

(iii) a maximum boiling azeotrope (iv) an acidic solution

14. Give the Nernst equation for the potential of a copper electrode.

15. The following mechanism has been proposed for the enzyme catalysis

$$E + S \underset{k_{-1}}{\overset{k_1}{<=========>}} ES \; ; \; ES \xrightarrow{k_2} P + E$$

Using steady state approximation for [ES], write the rate of the reaction.

16. Give an example for a system having upper cum lower CST.

0.25×16 = 4

Section B, Weightage 1 each (short answer type)
(Answer any eight questions from the following. Each answer must contain 4 points.)

17. Define the term activation energy. Why different reactions proceed at different rates?

18. Give one example each for a consecutive and a parallel reaction

19. What is meant by common ion effect? Explain with an example.
20. Define buffer solution and buffer index .
21. Describe with example (i) Triple point (ii) Eutectic point
22. Explain the term congruent melting point with an example
23. What is critical solution temperature? How does it vary by the addition of an electrolyte?
24. What are azeotropes ? Explain with an example.
25. What is meant by liquid junction potential? How can it be almost eliminated?
26. How will you construct a calomel electrode?
27. What is Debye Falkenhagen effect?
28. Write a note on conductometric titration of acetic acid against sodium hydroxide? **1×8 = 8**

Section C, Weightage 2 each (short essay type)

(Answer any five questions from the following.) Each answer must contain 8 points.

29. The rate constant of a second order reaction is 5.70×10^{-5} dm^3 mol^{-1} S^{-1} at 25^0C and 1.64×10^{-4} dm^3 mol^{-1} S^{-1} at 40^0C. Calculate the activation energy and the Arrhenius pre-exponential factor.
30. 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 25^0C is 1.75×10^{-5}.
31. Explain the principle of freezing mixture by taking KI – H_2O system as an example.
32. State and explain Nernst distribution law. What are the limitations of the law?
33. What are fuel cells? Describe H_2 – O_2 fuel cell and its cell reactions.
34. Explain the terms (i) Fluorescence (ii) Phosphorescence
35. What are the laws of photochemistry , explain ?
36. Derive Clausius- Clapeyron equation and mention its applications . **2×5 = 10**

Section D, Weightage 4 each (long essay type)

(Answer any two questions.)

37. Discuss in detail Lindemann theory of unimolecular reactions.
38. (a) Derive van't Hoff equation for temperature dependence of equilibrium constant.
(b) The equilibrium constant for a reaction is 1×10^5. Calculate the standard free energy change for the reaction in kilojoules at $25^?$ C .
39. How will you determine the transport number of ions by moving boundary method?

4×2 = 8

B.Sc Chemistry (Programme) 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.

B.Sc Chemistry Programme
SEMSTER I, III & IV
Course Code CH1141, CH1341 (Lab Course I)
Three hours examination in semester IV. (Credit 2)
(2013 admission onwards)

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

B.Sc Chemistry Programme Laboratory Course
Semester II & V
Course Codes CH1544
Inorganic Volumetric analysis (Lab Course Number II)
(Credit 5) Three hours examination in semester V*

(2013 admission onwards)

Inorganic Volumetric analysis (Double Burette titration)

(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) Nitric and (6) MnO_2 in pyrolusite.

(c) Dichrometry

Determination of Ferrous iron using internal indicator and Ferric iron after reduction with $SnCl_2$.

(*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 KIO_3, 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 $ZnSO_4$ – determination of Zn, Mg, Ni and Ca – determination of permanent and temporary hardness of water.

B.Sc Chemistry Programme Laboratory Course
Semester V
Course Codes CH1545
Physical Chemistry Experiments (Lab Course Number III)
(Credit 4) Three hours examination in semester V*

(2013 admission onwards)

I. 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.

B.Sc. Chemistry Programme Laboratory Course
Semester VI
Course Code CHI644 (Lab Course IV)
Organic Chemistry Experiments.

Three hours examination in semester VI[#] (Credit 5)

(2013 admission onwards)

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. 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 of an ester

B.Sc. Chemistry Programme Laboratory Course
Semester VI
Course Codes CHI645 (Lab Course V)
Gravimetry

Three hours examination in semester VI[#] (Credit 4)

I. 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

II. 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

***Examination for CH1544 Lab course II and CH1545 lab course III may be conducted on the same day for 6 hrs at a stretch.**

[#] Examination for CH 1644 Lab course IV and CH 1645 lab course V may be conducted on the same day for 6 hrs at a stretch.

UNIVERSITY OF KERALA

B.Sc. CHEMISTRY PROGRAMME (CORE) SEMESTER IV

CH 1442 LABORATORY COURSE (PRACTICAL) EXAMINATION

SCHEME OF VALUATION

TIME -3 HRS

WEIGTAGE: 30

a. Components for End Semester Evaluation: Inorganic Qualitative Analysis

(weightage 24)

Sl.No.	Component	Grade awarded	*Grade point	Weightage	#Weighted Grade point
I	ANSWER TO THE QUESTION	All four correct : A Only three : B Only two : C Only one : D None : E		1	
II	**Preliminary experiments** 1. Colour and appearance 2. Solubility/Action of heat 3. Flame test 4. Action with NaOH	All four : A Only three : B Only two : C Only one : D None : E		1	
III	**Preliminary tests for anions** 1. Action with dil.HCl 2. Action with con.H_2SO_4 3. Action with H_2SO_4 & MnO_2 4. Action with H_2SO_4 & paper ball 5. Ethyl Borate test 6. Ethyl acetate test 7. Ammonium molybdate test 8. NaOH & Al powder	Seven or eight : A Five or six : B Three or Four : C One or Two: D None : E		2	
IV	**Systematic tests for anions** 1. Preparation of sodium carbonate extract 2. Dil. HNO_3 + $AgNO_3$ 3. Dil. HCl + $BaCl_2$ 4. Dil. HCl + Zirconyl Nitrate 5. Dil.CH_3COOH + $CaCl_2$ 6. $FeCl_3$ test 7. Brown ring test 8. Systematic recording	Seven or eight : A Five or six : B Three or Four : C One or Two: D None : E		3	
V	1. Confirmatory test of 1st anion 2. Correct identification of 1st anion 3. Confirmatory test of 2nd anion 4. Correct identification of 2nd anion	All four correct : A Only three : B Only two : C Only one : D None : E		5	
VI	1. Intergroup separation with systematic recordings 2. Elimination of interfering anion/intragroup separation 3. Group identification for cation I 4. Group identification for cation II	All four correct : A Only three : B Only two : C Only one : D None : E		4	

VII	Two CORRECT tests (Test reagents + observation + inference) for 1st cation Two CORRECT tests (Test reagents + observation + inference) for 2nd cation	All four correct : A Only three : B Only two : C Only one : D None : E		8	

b. Sub-Components for Lab report (weightage 6)

	LAB REPORT	**Grade awarded**	***Grade point**	**Weig htage**	**#Weighted Grade point**
I	No. Experiments Qualitative analysis : 12 mixtures	Twelve – A Grade Eight – B Grade, four –C Grade, >four – D grade None – E Grade		4	
II	Reactions of ions with equations, Spot test, Correct recording and Neatness	All four : A Only three : B Only two : C Only one : D		1	
III	Inorganic Preparations	Six – A Grade Five – B Grade Four – C Grade <Three – D grade None – E Grade		1	
Total Weighted Grade point for Lab Report			**b**		

***Grade point : A=4, B=3, C=2, D=1**

#Weighted Grade point = Grade Point x weightage

* $GRADE\ POINT\ EARNED = \frac{\text{Weighted Grade point of a + b}}{30} =$

GRADE =

UNIVERSITY OF KERALA
B.Sc. CHEMISTRY PROGRAMME (CORE) SEMESTER V
CH 1544 LAB COURSE II (PRACTICAL)
INORGANIC VOLUMETRIC ANALYSIS
SCHEME OF VALUATION

TIME -3 HRS
WEIGTAGE: 30

Components for end semester evaluation of Volumetric anlaysis

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. wt.	Weighted grade point iii × iv
I	Lab Report-	12 expts : A 8 expts : B 4 expts : C <4 expts : D None : E		6	
II	Procedure- 1. Correct intermediate 2. Preparation of standard solution 3. Standardization of intermediate 4. Indicator and end point 5. Making up of given solution 6. Titration of made up solution 7. Indicator and end point 8. Any other relevant points	All eight sub components: A Only six: B Only four: C Only two: D None : E		2	
III	STANDARDISATION				
a	Tabulation, Lab skill, Calculation AND Neatness	All Four sub components: A Only three: B Only two: C Only one: D None : E		5	
IV	ESTIMATION				
A	Tabulation, Lab skill, Calculation AND Neatness	All Four sub components: A Only three: B Only two: C Only one: D None : E		5	
	Accuracy of the result (Estimation)	Up to 1.5% error A 1.51 – 2.5% B 2.51 – 3.5% C > 3.5% D		10	
IV	Viva	Correct Answer to 4 Questions: A 3 Questions: B 2 Questions: C 1 Question: D None : E		2	

UNIVERSITY OF KERALA

B.Sc. CHEMISTRY PROGRAMME (CORE) SEMESTER V

CH 1545 LAB COURSE III (PRACTICAL)

PHYSICAL CHEMISTRY EXPERIMENTS

SCHEME OF VALUATION

TIME -3 HRS

WEIGTAGE: 30

Components for end semester evaluation of Physical chemistry experiments

SI No	**i. Main Components and sub components**	**ii. Grade**	**iii. Grade point A=4, B=3, C=2, D=1, E=0**	**iv. wt.**	**Weighted grade point iii × iv**
I	Lab Report-	12 expts : A 8 expts : B 4 expts : C <4 expts : D None : E		6	
II	Procedure- 1.Principle of the Experiment 2.Relevant equation /graph 3.Materials and apparatus 4. Procedure	All Four sub components: A Only three: B Only two: C Only one: D None : E		2	
III	Neat tabulation and systematic recording 1.Correct representation of data 2.Graphical representation 3.Satisfactory skill in experimentation 4. Neatness of data and result presentation	All Four sub components: A Only three: B Only two: C Only one: D None : E		4	
IV	Viva	Correct Answer to 4 Questions: A 3 Questions: B 2 Questions: C 1 Question: D None : E		2	
V	Performance of experiment, calculation and accuracy of the result (*accuracy may depend upon the experiment*)	Details of grade distribution given separately		16	

UNIVERSITY OF KERALA

B.Sc. CHEMISTRY PROGRAMME (CORE) SEMESTER V

CH 1644 LAB COURSE IV (PRACTICAL)

ORGANIC CHEMISTRY EXPERIMENTS

SCHEME OF VALUATION

TIME -3 HRS

WEIGTAGE: 30

Components for End Sem Evaluation of Organic Chemistry Experiments				
No	***Main Component*** ***Sub-Components***	***Grades***	***Weight***	***Weighted grade point***
1	Lab report i. Required No: of Experiments done ii. Data and experimental details sufficient iii. Correctness of results reported iv. Neatness of presentation and absence of errors/mistakes in the Record Book	All 4 subcomponents : A Only three : B Only two : C Only one D None : E:	6	
2	Procedure & Lab skill i. Procedure of preparation- method ii .Procedure of preparation - equation iii. Lab skill, iv. Neatness	All 4 : A Only three : B Only two : C Only one D None : E:	2	
3	Two preliminary experiments Na fusion extract preparation Test for elements N / halogens	All four correct : A Only three : B Only two : C Only one : D None : E	3	
4	Two tests each for Aromatic/aliphatic & saturated/unsaturated	All four : A Only three : B Only two : C Only one : D None : E	3	
5	Systematic analysis Identification test - functional group Confirmation test	All four : A Only three : B Only two : C Only one : D None : E	6	
6	Viva	4 Questions: A 3 Questions: B 2 Questions: C 1 Question: D None : E	2	
7	Preparation & physical constants i. Quality of the Recrystallized Compound Prepared ii. Quantity of the Compound Prepared iii Physical Constants iv. Preparation of derivative	All 4 subcomponents : A Only three : B Only two : C Only one : D None : E	8	

UNIVERSITY OF KERALA

B.Sc. CHEMISTRY PROGRAMME (CORE) SEMESTER V

CH 1645 LAB COURSE V (PRACTICAL)

GRAVIMETRIC ANALYSIS

SCHEME OF VALUATION

TIME -3 HRS

WEIGTAGE: 30

Components for End Sem Evaluation of Gravimetric Analysis				
NO	**Main component**	**Sub component**	**Grade**	**Weight age**
1	Lab Course Report i. Required No: of Experiments done ii. Data and experimental details sufficient iii. Correctness of results reported iv. Neatness of presentation and absence of Errors/mistakes	All four : A Only three : B Only two : C Only one : D None : E	6	
2	Principle and Procedure i. Principle of the experiment stated & correct ii. Aim of the experiment stated & correct iii. Procedure stated & correct iv. Materials & apparatus specified	All four : A Only three : B Only two : C Only one : D None : E	4	
3	Experiment Report & Lab Skill i. Correct Equation and Result Representation ii. Correct Calculation iii Satisfactory skill in experimentation iv. Neatness of data and result presentation	All four : A Only three : B Only two : C Only one : D None : E	8	
4	Viva	All four : A Only three : B Only two : C Only one : D None : E	2	
5	Calculations & Result i. <1.5% ii. >1.5- < 2.0 iii.> 2.0 - < 2.5 iv.> 2.5 - < 3.5 v. > 3.5	A B C D E	10	

Note: If necessary, the schemes given above for Lab course I – V may be modified by the respective Board of Examiners

University of Kerala
Open Course for Other Majors-Semester-5 Credit-2
Course-CH1551.**1**
2011 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. Graw Hill ,“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
2011 admission onwards
Open Course for other Majors Course CH1551.1
Essentials of Chemistry

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 0.25 eah

(answer in a word \ sentence)

Answer all questions

I 1. One orbital can accommodate a maximum of_____electrons.
2. _____states that orbitals are filled in the increasing order of energy.
3. There are _____quantum numbers.
4. The shape of s orbital is _____.

II 5. Who discovered radioactivity?
6. What is the mathematical expression for the half life period of a 1st order reaction?
7. Name any unit of radioactivity.
8. Who proposed Group Displacement law?

III. 9. Bakelite is a polymer of phenol and _____.
10. Monomer of Nylon 6,6 is _____.
11. An example of an inorganic polymer is _____.
12. Name any compound which causes acid rain.

IV. 13. Name an enzyme.
14. Write an example of a sex hormone.
15. What is the expansion of DNA?
16. Write an example for a dye. **0.25×16 = 4**

Section B, Weightage 1 each (Short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. Name the pollutants in air?
18. What are the factors affecting the purity of water?
19. Explain Hund's rule of maximum multiplicity with an example.
20. Define electron affinity, explain with an example.
21. Distinguish between half life period and average life period.
22. Explain artificial radioactivity.
23. Write the structure and applications of polyhalo olefins.
24. What is vulcanization of rubber?
25. What are corticosteroidal hormones? Explain with example.
26. Distinguish between DNA and RNA.
27. How are dyes classified?
28. Explain cleansing action of soap. **1×8 = 8**

Section C, Weightage 2 each (Short essay type)

Answer any five questions from the following. Each answer must contain 8 points.

29. Explain the source and hazards of fly ash and asbestos.
30. Explain briefly soil pollution.
31. What are periods and groups in the periodic table? What is periodicity?
32. Explain Bohr model of atom.
33. Distinguish between nuclear fission and nuclear fusion with examples.
34. What are Nylon 66, Melamine and Terylene?

35. What are the functions and deficiency diseases of Vitamin C, Vitamin D and Vitamin E.
36. Write a note on explosives. **2×5 = 10**

Section D,

Weightage 4 each (Long essay type)

Answer any two questions.

37. Write an essay on plastic waste and long term use of fertilizers.
38. What are quantum numbers? Explain.
39. Explain Group Displacement law and radioactive decay series. **4×2 = 8**

Open Course For Other Majors-Semester-V Credit-2

Course-CH1551.**2**

2011 admission 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 chemistry-alchemy, 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. (*No structural formula and preparation needed*) ***9 hrs***

Household materials – Major chemical ingredients, 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.

References

1. M. C. Day and J. Selbin," Theoretical Inorganic Chemistry".
2. F. A. Cotton, G. Wilkinson and P. L. Gaus, "Basic Inorganic Chemistry"
3. J. D. Lee, "Concise Inorganic Chemistry"
4. M. C. Day and Selbin "Theoretical Inorganic Chemistry"
5. N.C. Datta "The Story of Chemistry"
6. Carl H. Snyder "The Extra Ordinary Chemistry Of Ordinary Things"
7. John Emsley " The Consumer's Good Chemical Guide"

University of Kerala
Model Question Paper
2011 admission onwards
Open Course for other Majors Course CH1551.2
Fundamentals of Chemistry & Its Application to Everyday Life

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 0.25 eah

(answer in a word / sentence)

Answer all questions

I 1. The modern atomic theory is called:_____

2. _____states that orbitals are filled in the increasing order of energy.

3. Name an artificial sweetener?

4. The shape of s orbital is _____.

II 5. Who proposed the atomic theory?

6. The branch of chemistry which deals hydrocarbons and their derivative is called_____. .

7. What is superphosphate?

8. Who is the Father of Modern Chemistry?

III. 9. How many atoms are present in a molecule of ozone?

10. Two atoms with the same number of protons but different number of neutrons are called _____

11. What is a diamond made up of?

12. Which element has the electron configuration 2,1.

IV. 13. Name a liquid element.

14. What is the shape of water molecule?

15. How many valence electrons are there in carbon?

16. Name the main compound present in cooking gas.

0.25×16 = 4

Section B, Weightage 1 each (Short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. Name any two Toxic Chemicals in Cosmetics

18. Obtain the electron configuration for (a) N; (b) F.

19. Explain Hund's rule of maximum multiplicity with an example.

20. Define electron affinity, explain with an example.

21. Which of the following elements Li, Be, B, C, N, O, F and Ne

are metals?

22. Explain Bohr model of atom.
23. Why is the electronegativity value of most noble gases equal to zero?
24.What are the Health Effects of Drinking Soda?
25. Which do you expect to have more metallic character, Lead (Pb) or Tin (Sn) ?
26 What is a Match Head of match stick made Of?
27. Explain why graphite conducts electricity whereas diamond doesn't.
28. Is the reactivity of group I metals increasing or decreasing down the group? Explain why?

$1 \times 8 = 8$

Section C, Weightage 2 each (Short essay type)

Answer any five questions from the following. Each answer must contain 8 points.

29. Explain the colour of firecrackers.
30. What is the difference between covalent and ionic bonding?
31. What are periods and groups in the periodic table? What is periodicity?
32. What are adulterants.
33. How is Thomson's model of the atom different from Dalton's model of atom?
34. What's the difference between an oxidation number and an ionic charge?
35. Explain the health hazards associated with drinking soft drinks ?
36. How can metallic character change across a period?

$2 \times 5 = 10$

Section D, Weightage 4 each (Long essay type)

Answer any two questions.

37. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius
38. The pH of aqueous solutions of elements in the third period changes as the period is crossed. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
39. Explain the role of some chemicals in household items **$4 \times 2 = 8$**

Open Course for Other Majors-Semester-5 Credit-2

Course-CH1551.**3**

2011 admission onwards

Environmental Chemistry

Module -I ***9 hrs***

Environmental Components: Structure and composition of the - Atmosphere, hydrosphere, biosphere and Lithosphere –

Module -II ***9 hrs***

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.

Module -III ***9 hrs***

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

Module -IV ***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 ***9 hrs***

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

Module -VI ***9 hrs***

Major environmental laws: Clean Air Act, Clean Water Act, Safe Drinking Water Act, Oil Pollution Act, Pollution Prevention Act, Toxic Substances Control Act, Occupational Safety and Health Act. Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (*elementary ideas only*)

References

1. A. K. Srivasthava and P. C. Jain, “Chemical Analysis”
2. B. K. Sharma “Air Pollution”.
3. V. K. Ahluwalia “Environmental Chemistry”
4. G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”
5. Rashmi Sanghi and M.M Srivasthava, “Green Chemistry Environment Friendly Alternatives”,

University of Kerala
Model Question Paper
2011 admission onwards
Open Course for other Majors Course CH1551.3
Environmental Chemistry

Time: Three Hours **Maximum Weightage : 30**

Section A, Weightage 0.25 eah

(answer in a word \ sentence)

Answer all questions

I 1. Organomercury poisoning occurred at_____ near Japan.

2. _____ is a major contributor to greenhouse effect.

3. Methyl isocyanate is related to the environmental tragedy occurred at _____.

4. The _____ is the rigid outermost shell of a rocky planet.

II 5. Which agency formulated the Pollution Prevention Act of 1990?

6. Triple R in waste management is Recover, _____ and Reuse.

7. The _____ Protocol is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion.

8. Primary sewage treatment removes _____ percentage of the BOD from domestic sewage.

III. 9. What type of pollution causes acid rain?

10. Itai-itai disease was caused due to _____

11. What are the misuses of plastics?

12. Chlorofluorocarbons cause _____

IV. 13. What are the three major man made sources of air pollution?

14. _____ resulted in the highest known exposure to TCDD in residential populations

15. What kind of materials are discharged into the seas?

16. What increases the amount of carbon dioxide in the atmosphere?

0.25×16 = 4

Section B, Weightage 1 each (Short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. How is pollution related to acid rain?
18. How does ocean pollution affect sea animals?
19. What are the main concepts of Green Chemistry
20. Write short note on Radioactive pollution
21. Discuss the major composition of earth's atmosphere
22. Write about the cause and consequence of Chernobyl incident
23. What is BOD and COD?
24. What causes radioactive pollution?
25. Distinguish between Hard water and soft water.
26 What is the goal of Toxic Substances Control Act?
27. What is the Greenhouse effect and what is its cause?
28. Write short note on causes and problems of ozone layer depletion?

1×8 = 8

Section C, Weightage 2 each (Short essay type)

Answer any five questions from the following. Each answer must contain 8 points.

29. Write short note on volatile organic compounds
30. How can thermal pollution be prevented?
31. How do you control Radioactive pollution?
32. What is smog? How does smog arise?
33. What is Eutrophication
34. What do you mean by Occupational Safety
35. Explain the various layers of the Atmosphere
36. What is Air Pollution? How can air pollution be minimized?

2×5 = 10

Section D, Weightage 4 each (Long essay type)

Answer any two questions.

37. Explain the causes of Hardness of water. What are the measures adopted to reduce or remove hardness of water.
38. Discuss the major environmental laws and their influence on regulating the pollution
39. Discuss the various sampling techniques for water quality analysis. What are the major water quality standards? **4×2 = 8**

B.Sc. Chemistry programme
Elective-Semester-6 Credit-2 Course-2 Course Code – CH1661 .1
Supramolecular, Nano Particles and Green Chemistry---54 hrs
(2013 admission onwards)

Module I Green Chemistry-1 ---9hrs
Role of Chemical Industries in polluting the environment-Limitations of conventional waste management-pollution 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-thinfilms-multilayered 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
2013 onwards
B.Sc Chemistry Programme
Elective Course Semester VI Course Code
CH1661.1 Supramolecular, Nano Particles and Green Chemistry

Time: Three Hours Maximum **Weightage : 30**

Section A, Weightage 0.25 each (answer in a word \ sentence)

Answer all questions

I 1. Union carbide factory in Bhopal was involved in the manufacture of _____.
2. _____is an example of supercritical fluid.
3. _____is a safer chemical.
4. Size of nano gold particle will be between _____ to _____nm.
II. 5. Write an advantage of super critical fluid.
6. Write an example of a green catalyst.
7. Lycurgus cup contains _____ nano particle.
8. Name a colloidal semi conductor.
III. 9. SEM stands for _____.
10. AFM uses _____ to scan the surface of a material.
11. The STM is based on_____ of electrons.
12. Carcerand are designed to contain _____.
IV. 13. A photosensitive molecular receptor contains _____ as a photosensitive functional group.
14. Cation carriers generally contains_____ charged functional groups.
15. Who proposed the correct structure of DNA ?
16. Between an addition and elimination reaction _____ has a better atom economy. **0.25×16 = 4**

Section B, Weightage 1 each (short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. Which factors lead to the development of green chemistry ?
18. Write a note on Bhopal gas tragedy .
19. Comment on the greenness of liquid bromine as a reagent.
20. Explain co-precipitation.
21. What is hydrothermal methods of preparing colloidal semiconductors.
22. What are the magnetic properties of nanoparticles.
23. What is pi stacking ?
24. Explain the basis of green chemistry.
25. What are the non-covalent bonds involved in molecular recognition?
26. Explain high energy ball milling.
27. What are quantum dots ?
28. How are multi walled carbon nano tubes synthesized? **1×8 = 8**

Section C, Weightage 2 each (short essay type)

Write any five from he following. Each answer must contain 8 points.

29. Write a note on safer solvents and auxiliaries.
30. Explain ionic liquids.
31. What is the principle of microwave oven'
32. How can atom economy be calculated?
33. Explain sono chemistry.
34. Write a note on applications of nano particles.
35. What are cyclophanes and calix arenes ?
36. Discuss cation and anion receptors. **2×5 = 10**

Section D, Weightage 4 each (long e ssay type)

Write any two

37. Explain the terms, Ionic Bonding, H- bonding, van der Waal and hydrophobic interactions.
38. Explain the principles of green chemistry.
39. Discuss the various aspects of molecular recognition involved in the structure of DNA and proteins. **4×2 = 8**

B.Sc Chemistry Programme
ELECTIVE COURSE
Semester-6 Course-2 Credit-2 Course Code – CH1661.2
Computational, Combinatorial and Physical Organic Chemistry
(2013 admission onwards)

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 on 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 – ?H, ?S and ?G 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

B.Sc Chemistry Programme
2013 admission onwards
MODEL QUESTION Elective Course- Course Code CH1661 .2
Computational, Combinatorial and Physical Organic Chemistry
Time: Three Hours Maximum Weightage : 30
Semester VI

Section A, Weightage 0.25 eah (answer in a word\sentence)
Answer all questions

I. 1. DFT stands for _____.
2. RHF is the abbreviation of _____.
3. Modified version of RHF is _____.
4. The expansion of UHF is _____
II. 5. Who first proposed solid phase peptide synthesis ?
6. _____ is an example of electrophilic reagent.
7. The relation connecting ?H,?S and ?G ?
8. Propene is more stable than ethane due to_____ .
III. 9. _____ synthesis is an example of solution phase library synthesis.
10. Combinatorial synthesis is based on_____ and _____ synthesis.
11. _____ is an example of heterolytic bond breaking reaction.
12. Arrhenius expression is _____ .
IV. 13. Write Hammett equation.
14. An example of polyamide resin.
15. An example of nucleophilic reagent is ____ .
16. All pericyclic reactions involve a _____ intermediate. **0.25×16 = 4**

Section B, Weightage1 each (short answertype)
Answer any eight questions from the following. Each answer must contain 4 points.
17. What are the web resources in learning Chemistry?
18. What is a basis set ?
19. What are the major mechanisms of organic reactions ?
20. Distinguish between STO & GTO.
21. Explain the advantages of combinatorial synthesis.
22. Write an example of an electrocyclic reaction..
23. What are the applications of combinatorial synthesis.
24. What are multipins used in combinatorial synthesis
25. Explain kinetic requirements of reaction .
26. Explain Hammond postulate.
27. Explain +I and – I effects.
28. Explain isotopic labeling in the study of organic reactions. **1×8 = 8**

Section C, Weightage 2 each (short essay type)
Answer any five questions from the following. Each answer must contain 8 points.
29. Explain Z matrix of H_2O & NH_3
30. How are molecular visualization softwares used in learning chemistry..
31. How can a eight – member dipeptide library is synthesized ?
32. Explain non-peptide libraries.

33. How are the intermediates detected?
34. Explain substitution reactions of naphthalene.
35. Explain the effect of leaving group in aliphatic substitution reactions.
36. What is self consistent field method. **2×5 = 10**

Section D, Weightage 4 each (Long essay type)

Answer any two questions

37. Explain MO theory of hydrogen molecule ion and VB theory of hydrogen
38. Explain neighbouring group participation with examples.
39. How does the structure of substrate affect the aliphatic nucleophilic substitution?

4×2 = 8

B.Sc Chemistry Programme

ELECTIVE-COURSE

2013 admission onwards

Semester-6 Credit-2 Course-2 Course Code - CH1661.3

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

2013 admission onwards

Course Code CH1661.3 Polymer Chemistry

Time: Three Hours Maximum **Weightage : 30**

Section A (Weightage 0.25 each) (Answer in one word\sentence)

Answer all questions

I 1. Name of one natural polymer.
2. Name of one condensation polymer.
3. Name of one inhibitor of chain reaction.
4. Name one addition polymer.

II 5. Bakelite is a polymer of formaldehyde and _____.
6. Silicones have the linkage of _____.
7. One amino resin is _____.
8. HDPF is _____.

III 9. What is SBR.
10. What is the structure of the monomer of polyvinyl acetate.
11. What are the monomers of nylon .
12. What is the monomer o neoprene.

IV. 13. One polymer industry in India is at_____.
14. LLDP is _____.
15. SAN is _____.
16. Teflon is _____. **0.25×16 = 4**

Section B (Weightage 1 each) (short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. What are the different types of polymers?
18. Explain the different types of polymerization.
19. What is polyvinylacetate ?
20. Distinguish between graft and copolymers.
21. How is melamine-formaldehyde resin prepared?
22. What are elastomers?
23. Write a note on polyolefine.
24. Compare nylon 6 with nylon 6,6.
25. What is the practical significance of molecular weight distribution?
26. Explain fibre spinning.
27. Explain extrusion.
28. What is Carother's reaction. **1×8 = 8**

Section C (Weightage 2 each) (Short essay type}

Answer any five from the following. Each answer must contain 8 points.

29. Explain number , weight and viscosity average molecular weight.
30. Explain kinetics of polymerization.
31. Explain the preparation of PVC.
32. Explain synthesis and applications of polyurethanes.

33. What are epoxy resins?
34. Explain the size of polymers.
35. What are the factors affecting GTT.
36. Explain polymer processing. **2×5 = 10**

Section D (Weightage 4 each) (essay type)
Answer any two

37. What are the methods of determining molar mass?
38. Write notes on (1) compression (2) moulding(3) casting
39. (a) Explain crystallinity in polymers (b) Explain thermal, electrical and mechanical properties of polymers. **4×2 = 8**

B.Sc Chemistry Programme
2013 admission onwards
Syllabus
Elective Semester-6 Course-2 Credit-2 Total :54Hrs
Course Code – CH1661 .4 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 O_2 and CO_2 during respiration, Transport of Oxygen in Blood O_2 dissociation curve, Interrelationship between O_2 and CO_2 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
2013 admission onwards

Model Question Paper Elective Course Semester VI
Course Code CH1661 .4 Biochemistry

Time: Three Hours Maximum **Weightage : 30**

Section A (Weightage 0.25 each) (answer in a word\sentence)

Answer all questions

I

1. _____ is called good cholesterol.
2. _____ is the cause of sickle cell aneamia .
3. An example of plasma protein is _____.
4. An example of a lipo protein is _____.

II

5. Among the blood cells which is the largest blood cell.
6. NPN stands for _____.
7. Write the renal threshold value of glucose.
8. How much calories are obtained from 1 g of fat?

III.

9. Write the oxidation state of iron in haemoglobin.
10. Name one bile pigment.
11. Technique used to separate bio molecules according to the size.
12. Expand GLC.

IV.

13. Normal pH of blood is_____.
14. Haemoglobin combines with CO_2 to form_____.
15. Name of the primary bile acid is _____.
16. Enzyme present in gastric juice is _____ **0.25×16 = 4**

Section B (Weightage1 each) (short answer type)

Answer any eight questions from the following. Each answer must contain 4 points.

17. What is the difference between plasma and serum?
18. What is pulmonary respiration?
19. What are the constituents of plasma?
20. What is adsorption chromatography?
21. Write short notes on carbohydrates splitting enzymes.
22. Define BMR.
23. Define Rf value.
24. Comment on adult haemoglobin and foetal haemoglobin..
25. Draw the structure of haemo group.
26. What are the abnormal constituents of urine?
27. Write the functions of plasma protein.
28. Write a note on abnormal haemoglobin. **1×8 = 8**

Section C (Weightage2 each) (Short essay type)

Answer any five from the following. Each answer must contain 8 points.

29. Explain O_2 dissociation curve.
30. Explain the interrelationship between O_2 and CO_2 transport.
31. Explain SDS PAGE.
32. Define briefly blood cells.
33. Comment on major blood buffers.
34. Write the composition and function of bile.
35. Explain paper chromatography.
36. Briefly describe ion exchange chromatography. **2×5 = 10**

Section D (Weightage4 each)

Answer any two (essay type)

37. Explain the digestion and absorption of fat.
38. What are the functions of kidney? Explain urine formation in detail.
39. What are coagulation factors? Explain the mechanism of coagulation?

4×2 = 8