UNIVERSITY OF KERALA

SCHEME AND SYLLABI OF

COMPLEMENTARY CHEMISTRY COURSES FOR OTHER FIRST DEGREE PROGRAMMES UNDER CBCSS

(PHYSICS, GEOLOGY, BOTANY, ZOOLOGY, HOMESCIENCE, BIOCHEMISTRY & MICROBIOLOGY)

2020 ADMISSION ONWARDS

COMPLEMENTARY CHEMISTRY COURSES UNDER CBCSS

OFFERED TO OTHER MAJORS

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UNIVERSITY OF KERALA

COMPLEMENTARY CHEMISTRY COURSES

(OFFERED TO FIRST DEGREE PROGRAMMES)

The Complementary Chemistry Syllabus has been designed to motivate students of other majors of **PHYSICS, GEOLOGY, BOTANY, ZOOLOGY, HOMESCIENCE, BIOCHEMISTRY & MICROBIOLOGY** towards chemistry with a potential to contribute to the academic and industrial requirements of the society, in hand with their major discipline. The new, updated syllabus is in accordance with the OUTCOME BASED EDUCATION (OBE) which aim at acquiring advanced knowledge in different branches of Chemistry, in an interdisciplinary way. The **CORSE OUTCOME (CO**) for each course is specified as **CO1, CO2** etc in terms of cognitive levels achieved by each course.

Complementary Courses in Chemistry aim at certain Programme Specific Outcome (PSO) in consistent with those of the major courses.

PSO1: Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)

PSO2: Develop skill in safe handling of chemicals and glass wares, take precaution against accidents and follow safety measures.

PSO3: Avoid random usage of dangerous chemicals and Use chemicals in a critical way

PSO 4: Acquire a comprehensive knowledge of Chemistry, its impact on human, society and the environment to lead a better life in harmony with nature.

DISTRIBUTION OF HOURS AND CREDITS

TOTAL NUMBER OF SEMESTERS -4

COMPLEMENTARY CHEMISTRY LECTURE COURSES-4

COMPLEMENTARY CHEMISTRY LAB COURSE-1

(Two hours/week in all semesters, One Semester–18 Weeks)

TOTAL CREDITS–14

Semester	Hours per week		Number of Credits	*Course Code	Instructional Hours
	Theory	Lab			
1	2	2	2	CH1131 .1	2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .1	2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .1	3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .1 CH1432 .1	3×18 =54 2×18 = 36

*Applicable to Physics Major

GENERAL ASPECTS OF EVALUATION

MODE OF EVALUATION COMMON TO COMPLEMENTARY COURSES

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

CONTINUOUS EVALUATION FOR LECTURE COURSES (CE)

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

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

(ii) Assignment /seminar and

(iii) Test

Components for CE marks

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

EVALUATION OF THE ASSIGNMENTS AND SEMINAR

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

The assignment can be

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

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

QUESTION PAPER PATTERN FOR CONTINIOUS EVALUATION TEST

1. The theory examination has a duration of 1.5 hours
2. Each question paper has three parts: A, B , C
3. Section A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence.
4. Section B contains twelve questions. Out of these twelve questions, the students have to answer 7 questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Section C contains nine questions of which the candidate has to answer 4 questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).

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

Question Paper Pattern for CE Test		
Question No	Type of Question	Marks
Section A: 1-10	All / one word/one sentence	1X10=10
Section B: 11-22	7out of 12; Short Answer	7 X2=14
Section C: 23-31	4 out of 9; Short Essay	4 X4= 16
TOTAL	1 out of 2; Essay	40 marks

CONTINUOUS EVALUATION FOR LABORATORY COURSES

The Continuous evaluation for LAB COURSE will have 20 marks. The ESE of LAB COURSE will be done only in the IV semester. But the correspondinding CE are calculated from all the semesters in which there is attendance for laboratory sessions.

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

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EVALUATION OF THE RECORD

On completion of each experiment, a report should be submitted to the course teacher. All experiments should be recorded as Lab report in a bound volume. The experimental description should include aim, principle, materials/apparatus required/used, method/procedures and tables of data collected, equations, calculations, graphs, and other diagrams and the final results. The Certified RECORD is compulsory for the LAB COURSE ESE.

CE for Laboratory Record		
No.	**Sub component**	**Marks**
1	Punctual submission and Neat presentation	All four sub-components present &
2	Record of more than 90% experiments in the	

	syllabus	satisfactory 5
3	Calculations and absence of errors/mistakes	Only three : 4
4	Accuracy of the result	Only two : 3 Only one :2

LAB RECORD of experiments certified by the tutor and HoD should be submitted for verification by the External Examiner at the ESE.

END SEMESTER EVALUATIONS (ESE)

QUESTION PAPER PATTERN &

GUIDELINE FOR QUESTION PAPER SETTERS

1. The theory examination has a duration of 3 hours
2. Each question paper has four sections: A, B , C and D
3. Section A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence. Students have to answer all questions.
4. Section B contains twelve questions of which the students have to answer eight questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Section C have nine questions of which the candidate has to answer only six questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type).
6. Section D contains four questions of which the candidate has to answer any two. Each question carries **three subdivisions** amounting to a total of 15 marks.
7. The total marks for the entire questions to be answered is 80marks.
8. Question paper should contain 20% Remember, 60% Understanding and 20% application level according to OUTCOME BASED EVALUATION. Question paper setter shall submit a detailed scheme of evaluation along with question paper.

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

ESE FOR LAB COURSES

THE SCHEME OF EXAMINATION FOR LAB COURSES MAY BE FRAMED BY THE PRACTICAL CHEMISTRY BOARD OF EXAMINERS.

SYLLABUS OF COMPLEMENTARY CHEMISTRY COURSES

(FOR PHYSICS MAJORS)

DISTRIBUTUIN OF HOURS & CREDITS

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.1	2x18=36
		2	-		2x18=36
II	2		2	CH1231.1	2x18=36
		2	-		2x18=36
III	3		3	CH1331.1	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.1	3x18=54
		2	4	CH1432.1	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR PHYSICS MAJORS

2020 Admission onwards

SEMESTER	I
COURSE	1
COURSE NAME	THEORETICAL AND ANALYTICAL CHEMISTRY
COURSE CODE	CH1131.1
CREDIT	2
L-T-P	2-0-2
TOTAL HOURS	36

CO No.	**COURSE OUTCOME** ***Upon completion of this course, students,***	**Cognitive Level**
1	Discuss the rules for filling electrons in atomic orbitals	U
2	Correlate stability of atom with electronic configuration	U
3	Discuss theories of chemical bonding and their limitations	U
4	Predict geometry of molecules from the type of hybridisation	U,A
5	Recognise fundamentals of thermodynamics and the predict spontaneity of reactions	U,A
6	Derive thermodynamic properties of systems in equilibrium	A

7	Critically select suitable indicators for acid base and redox titrations	E,A
8	Appreciate the application of common ion effect and solubility product in precipitation and intergroup separation of cations	A
9	Discuss the basic principles of paper chromatography and thin layer chromatography	U
10	Solve numerical problems on bond order, molarity, normality and Lattice energy	A

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –PERIODIC CLASSIFICATION OF ELEMENTS (9hrs)

Quantum numbers and their significance,
Concept of orbitals. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals
Electronic configuration and classification of elements in to s,p,d and f blocks.
Periodic properties, Ionisation energy, Electronegativity and Electron affinity. Diagonal relationship.
Important characteristics of representative elements: valency, oxidation states, ionic and covalent bond formation
Important characteristics of transition elements : variable valency and oxidation states, formation of Complex compounds.

MODULE II - CHEMICAL BONDING (9hrs)

Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.
Polarity of covalent bond its relation with electronegativity
Electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity Dipole moment – its relation to geometry.
Hydrogen bond – inter and intra molecular – its consequences on boiling point,volatility and solubility.

Concept of Hybridisation– SP, SP^2, SP^3, dSP^2, dSP^3, SP^3d^2, and SP^3d^3 with examples
Explanation of bond angle in water and ammonia- VSEPR theory, geometry of molecules with bond pairs of electrons , bond pairs and lone pairs of electrons, limitations of VSEPR Theory.
A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O_2,O_2^{2+},O_2^{2-},NO,NO+,CO and HF.

MODULE–III: THERMODYNAMICS (9hrs)

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process.

Heat capacity of gases at constant volume and constant pressure, derivation of $C_P - C_V = R$.

Second law of thermodynamics, entropy and free energies

Significance of $\Delta G, \Delta H$ and available work

Criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

MODULE IV: ANALYTICAL PRINCIPLES (9 Hrs)

Analytical methods in Chemistry – Principles of volumetric analysis, primary standard, standard solution, Calculation of normality,molality and molarity of solutions

Theory of acid - base titrations: Strong acid-Strong Base, Strong acid-weak base, Weak acid Strong base and weak acid-strong base (Explanation with titration curves)

Redox titrations: Permanganometry-Fe2+ and KMnO4 and Dichrometry-Fe2+ and K2Cr2O7, Theory of acid – base and redox indicators.

Inorganic qualitative analysis, common ion effect- solubility product- precipitation and inter group separation of cations. Salting out process

Chromatography- principle and applications of paper and thin layer chromatography.

Text books/References

1. B.R Puri, L R Sharma K C Kalia, Principles of Inorganic Chemistry, Sobhanlal Nagin Chand&Co. New Delhi
2. Manas chanda,Atomic structure and Chemical bonding in molecular spectroscopy,Tata Mc Graw Hill
3. S Glasstone ,Thermodynamics for Chemists,Affiliated Eat West Publishers
4. J D Lee, Concise Inorganic Chemistry, ELBS
5. R P Rastogi and R R Misra, An Introduction to Thermodynamics
6. D.A Skoog, D M West, F J, Holler, S R Crouch, Fundamentals of Analytical Chemistry,8th Edn., Brookes/Cole, Thomson Learning,Inc, USA,2004
7. B K Sharma, Chromatography, Goel Publishing House, Meerut

UNIVERSITY OF KERALA
I Semester B.Sc Degree Examination Model Question Paper
Complementary Chemistry for Physics Major

Course code CH1131.1 Credit 2
THEORETICAL AND ANALYTICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp^3 hybridization?
4. Calculate the bond order of H_2 molecule.
5. What do you mean by solubility product?
6. Give the mathematical expression for first law of thermodynamics.
7. What is the significance of entropy?
8. Define Molality.
9. Which indicator you suggest for the volumetric titration of NH_4OH by HCl?
10. Name a primary standard substance for estimation of NaOH.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Give one example each for the stability of Half filled and fully filled atomic orbitals.
12. Write down the MO configuration of O_2 molecule.
13. Define lattice energy.
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?

16.Mention the rules for adding electrons to molecular orbitals?

17.Explain redox titrations with an example.

18.How would you prepare 100ml of 0.05M Mohr's salt solution?

19.Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20.What is the application of Gibbs Helmholts equation?

21.What is the principle of paper chromatography?

22. What is the theory of pH indicators?

(1x10=10 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Discuss the Born Haber cycle for the formation of NaCl.

24. Identify the hybridization in H_2O and NH_3. How will you account for the geometry of these molecules?

25. Give an account of acid base indicators.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Born-Haber Cycle considering the formation of NaCl as an example.

30. Write a note on spontaneity of a chemical reaction.

31. Explain briefly the principle and application of thin layer chromatography.

(4x6=24 marks)

SECTION D

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

32. (a) Discuss the basis of periodic classification into different blocks.

(b)What are quantum numbers? Give its significance.

(c) Explain various rules regarding electronic configuration. (5+5+5)

33. a) Define heat capacity of gases at constant temperature and pressure.

How are they related ?

b) What are the criteria for equilibrium? Discuss.

c) Discuss on the work of expansion of an ideal gas in reversible isothermal process. (5+5+5)

34. (a) Write a note on Hydrogen bonding and its consequences.

(b) How electronic configuration of molecules related to molecular behavior? Explain.

(c) Explain Fajan's Rule. (5+5+5)

35. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

(b) Explain the theory of redox indicators.

(c) Calculate the concentration in terms of normality and molarity of a solution of 8g of NaOH in 100 mL NaOH solution. (5+5+5)

(15x2=30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL AND INDUSTRIAL CHEMISTRY**
COURSE CODE	**CH1231.1**
CREDIT	**2**

L-T-P	2-0-2
TOTAL HOURS	**36**

CO No.	COURSE OUTCOME *Upon completion of this course, students,*	Cognitive Level
1	Define enthalpies of formation, combustion, neutralization, solution and hydration reactions	R,U
2	Apply Hess's law for thermo chemical calculations	A
3	Predict the effect of temperature pressure and concentration on a system in equilibrium based on Le Chatelier principle	U
4	Classify acidic and basic compounds in accordance with different concepts.	U
5	Suggest method for determination of pH	A
6	Discuss petrochemicals and their applications	
7	Realise the depletion of petroleum products and the need for alternate sources of energy.	U
8	Recognise the necessity of sustainable development	U
9	Appreciate the role of solar energy in photosynthesis and discuss methods of solar energy harvesting	U
10	Become responsible in the consumption of natural resourses and avoid factors affecting the harmony of nature from the equilibrium concept.	A
11	Discuss and the Illustrate general methods and techniques in metallurgy	U,A
12	Predict methods of concentration, extraction metals from their ores	A
13	Discuss the applications of Van Arkel method and zone refining in metallurgy	U

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: THERMO CHEMISTRY (9hrs)

Enthalpies of formation, combustion, neutralization, solution and hydration.

Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation,

Hess's law as an application of First law of thermodynamicsand its application Bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction. (Numerical problems to be worked out)

MODULE II : CHEMICAL AND IONIC EQUILIBRIUM (9 hrs)

Reversible reactions – K_P, K_C, and K_X and their inter relationships – Free energy change and chemical equilibrium (thermodynamic derivation) Influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2\ SO_3$

Le Chatelier's principle and the discussion of the above reactions on its basis.

Concepts of Acids and Bases, Arhenius, Lowry-Bronsted, and Lewis concepts.

HSAB Principle. Levelling effect.

pH and its determination by potentiometric method.

Buffer solutions – Henderson equation, Acidic and basic buffers-examples.

Hydrolysis of salts – degree of hydrolysis and hydrolytic constant,

Derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base.

MODULE III : PETROCHEMICALS AND ALTERNATE SOURSES (9hrs)

Petrochemicals:Introduction,Natural gas-CNG,LNG and LPG.

Coal: classification based on carbon content- Carbonisation of coal

Crude oil: constitution and distillation, composition and uses of important

Fractions

Ignition point, flash point and octane number-cracking

Usage and depletion of petroleum products.

Need for alternative fuel and Green Chemistry approaches for sustainable development:

Introduction, Solar energy harvesting- photosynthesis

Photo voltaic cell, conventional solar cells, nano structured solar cells,

Hydrogen as the future fuel

MODULE IV : METALLURGY (9 Hrs)

General principles of occurrence and extraction of metals

Concentration of ores- roasting, calcination and smelting

General Methods of extracting metal from concentrated ore, examples

Electro metallurgy-Metallurgy of Aluminium, Sodium-Pyrometallurgy

Refining of crude metals: Distillation, Liquation, electrolytic and zone refining

Chromatographic techniques and vapour phase refining (Mond's process and Van Arkel process)

Metallurgy of titanium, cobalt, nickel, thorium and uranium.

TEXT BOOKS /REFERENCES

1. B.R Puri, L R Sharma K C Kalia, Principles of Inorganic Chemistry , S. Chand & Co. New Delhi
2. B.R Puri, L R Sharma M S Pathania, Principles of Inorganic Chemistry , Vishal Publishing Co. New Delhi 2013
3. B K Sharma,H. Gaur, Industrial chemistry, Goel Publishing House, New Delhi
4. K S Tewari,N K Vishnoi, Organic Chemistry, 3rd Edn. Vikas Publishing House

UNIVERSITY OF KERALA
II Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course code CH 1231.1 Credit 2
PHYSICAL AND INDUSTRIAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Write one example for an exothermic reaction
2. Name a natural way of harvesting solar energy.
3. Mention two different forms in which natural gas is available.
4. What do you mean by ionic product of water?
5. Semi conductor grade Silicon is made by the technique--------
6. Identify the Lewis acid (HCl, NaOH, ,BF3,NH3)
7. Name the chemicals which can form an acidic buffer.
8. What is meant by carbonization of coal?
7. Give one example each for a Proton donor and a proton acceptor.
8. Name an oxide ore and a sulphide ore
9. What is the advantage of photovoltaic cell?
10. What is the application of Van Arkel method?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?

12. Give one application of first law of thermodynamics.

13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?

14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) ⟶ C_2H_6 (g).
    Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.

15. What is bond dissociation energy?

16. What is isochoric process?

17. What are the characteristics of equilibrium constant?

18. What is enthalpy of hydration?

19. What is a reversible process? Give an example.

20. Define Lewis acid and base

21. What is ionic product of water.

22. What is the importance of pyrometallurgy?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Calculate the bond energy of HBr bond,given that the enthalpy of formationof HBr is -36.2kJmol^{-1}. The bond energies of H-H and Br-BR bond are 431kJmol^{-1} and 188kJmol^{-1} respectively.

24. Write a note on HSAB principle.

25. Differentiate between ignition point and flash point.

26. Discuss n Mond's process and Van Arkel method.

27. Write a note on nanostructured solar cells.

28. How will you differentiate between liquation and distillation processes in metallurgy?

29. Give an account of crude oil, its distillation products and theur applications.

30. Comment on the use of hydrogen as a future fuel.

31. What is smelting? Give an example

SECTION D

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

32. a) Explain pH determination by potentiometric method
    (b) Differentiate between hard and soft acid
    (c) Write a note on leveling effect of solvents on acids. (5+5+5)

33. (a) Discuss the effect of pressure , temperature and concentration and mention the optimum conditios in the following reaction under equilibrium
    i) dissociation of $PCl5$ into PCl_3 and Cl_2
    ii) formation of SO_3 from $SO2$ and O_2
    (b) Illustrate the role roasting and calcinations in metallurgy. (5+5+5)

34. (a) Discuss on spontaneity or feasibility of a process.
    (b) State and explain Hesse's law.
    (c) When one mole of ethanol melts at its melting point, the entropy change is $29.4JK^{-1}$ mol^{-1}. If enthalpy of fusion of ethanol is 4.6 $kJmol^{-1}$, what is the melting point of ethanol?

35. (a) Discuss metallurgy of titanium
    (b) Compare between aluminothermy and hydrometallurgy.
    (c) Write notes on concentration of an oxide ore and a sulphide ore?

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**PHYSICAL CHEMISTRY**

COURSE CODE	**CH1331.1**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students will:*	Cognitive Level
1	Discuss on electrochemical cells and emf measurements	U
2	Apply the principles of physical Chemistry in Catalysis and photochemistry	A
3	Draw unit cells and structure of crystals	U
4	Understand the effect of temperature on molecular velocities of gases	R
5	Calculate cell emf and electrode potentials	A
6	Construct electrochemical cells	A
7	Classify between Photochemical reactions	U
8	Relate electrolyte concentration with emf	E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE 1: GASEOUS STATE **9HRS**

Maxwell's distribution of molecular velocities (No derivation) average, most probable and rms velocities, collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of vander waals constants and critical constants – Law of corresponding states – reduced equation of state, Joule Thomson effect, liquefaction of gases – Linde's and claude's processes

MODULE II – CRYSTALLINE STATE **9HRS**

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc of cubic crystals – Representation of lattice planes of simple cubic crystal - Density from cubic lattice

dimension – calculation of Avogadro number - Bragg equation, diffraction of Xrays by crystals – single crystal and powder method. Detailed study of structures of NaCI and KCl crystals.

MODULE III - ELECTRO CHEMISTRY 9HRS

Transport number – definition, determination by Hittorfs method and moving boundary method, application of conductance measurements. Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base.

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, Fuel cells – H_2 – O_2 and hydrocarbon – O_2 type.

MODULE IV – CATALYSIS AND PHOTOCHEMISTRY 9HRS

General Characteristics of catalytic reactions. Different types of catalysis – examples – theories of catalysis (Outline of intermediate compound formation theory and adsorption theory). Enzyme catalysis – Michaelis-Menten mechanism.

Photo Chemistry: - Laws of Photo Chemistry, Grothus – Drapter law, Beer Lambert's law, Einstein's laws, quantum yield, H_2 – Cl_2 reaction, H_2 – Br_2 reaction – Fluorescence and phosphorescence, chemiluminescence and photo sensitization.

MODULE – V: CHEMICAL KINETICS 9 HRS

Rates of reaction, various factors influencing rates of reactions – order and molecularity – Zero, first, second and third order reaction, derivation of integrated rate equation, fractional life time, units of rate constants, influence of temperature on reaction rates. Arrhenius equation, calculation of Arrhenius parameters – collision theory of reaction rates.

MODULE VI- GROUP THEORY 9 HRS

Group theory- elements of symmetry- proper and improper axis of symmetry- plane of symmetry-center of symmetry- identity elements, combination of symmetry elements- point group- C_{2v}, C_{3v} and D_{3h}- group multiplication table of C_{2v}- determination of point group of simple molecules like water, NH_3, BF_3

REFERENCES

1. B.R.Puri,L.R. Sharma and M.S.Pathania, Principles of Physical Chemistry, 46 th Edn Vishal Publishing Co. NewDelhi
2. J E Huheey, ,E A Keiter, R L Keiter, O K Medhi, Inorganic Chemistry, 4th Edn.Pearson
3. F A Cotton and Wilkinson,Advanced Inorganic Chemistry, John Wiley, New York
4. P L Soni, O P Dharmarsha,U N Dash,Textbook of Physical Chemistry, 23rd Edn, Sultan Chand & Sons, NewDelhi,2011
5. Gurudeep Raj ,Advanced physical chemistry
6. L V Azaroff, Introduction to solids
7. N B Hannay ,Solid state chemistry
8. F Daniel and R A Alberty ,Physical chemistry
9. A Salahuddin kunju and G krishnan Group theory and its applications in chemistry-

UNIVERSITY OF KERALA
III Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course Code CH1331.1 Credit 3
PHYSICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What is the ratio of observed molar volume to ideal molar volume is?
2. Define Boyle temperature?
3. How many unit cell are possible in cubic crystal?

4. Why amorphous solids are said to be isotropic?
5. In a Galvanic cell electron flows from …… to ……
6. What is the potential of SHE.
7. What is the quantum yield of H_2-Cl_2 reaction?
8. Define chemiluminescence
9. What is the order of the reaction with rate constant $2x10^{-2}$ $molL^{-1}s^{-1}$
10. NH_3 belongs to which point group?

SECTION B

*(Answer **any eight** questions. Each question carries **2** mark)*

11. Define critical temperature and explain its significance?
12. What is virial equation of states?
13. Explain the term Space lattice and Unit cell.
14. Both NaCl and KCl have fcc structures but Kcl behaves towards X-rays like simple cubic lattice. Why?
15. What is liquid junction potential? How can it be eliminated?
16. What are reference electrodes? Give their significance?
17. State Einstein's law of photochemical equivalence?
18. What is meant by chemiluminescence?
19. What is meant by autocatalysis?
20. Define order and molecularity of areaction?
21. A substance decomposes following first order kinetics. The half life period of a reaction is 35 minutes. What is the rate constant of the reaction?
22. What is meant by point group?

SECTION C

*(Answer **any six** questions. Each question carries **4** mark)*

23. What is the law of corresponding states? How is it derived from the vander waal's equation?
24. Calculate the constants a and b, if Tc=31^0C, Pc=72.8atm and R=0.082lit atm/K?
25. What are the Miller indices? How are they detrmined?
26. EMF of a standard Daniel Cell is 1.01832 V at 298K. Temperature coefficient of the cell is $-5x10^{-5}$V/K. Calculate ΔG, ΔH, and ΔS of the cell reaction?
27. Write a brief note on Calomel electrode?

28. State and explain Beer-Lambert's law? What are its limitations?
29. Explain pseudo order reactions with suitable examples?
30. Give the group multiplication table for C_{2V}
31. Explain the different symmetry elements?

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Explain Linde's and Claude's method of liquefaction of gases?

    (ii)Do all gases obey gas laws? Discuss some experimental results to explain the deviation and point out the causes which account for this behavior?

    (iii) explain the terms: collision frequency and collision diameter.

33. (i) Derive Bragg's equation for the diffraction of of X-rays by crystal lattice? How is this equation used in elucidating the crystal structure?

    (ii) In fcc lattice of NaCl the distance between Na^+ and Cl^- ions is 281 pm and the density of NaCl is 2.165g/cm^3. Compute Avogadro's no. from the given data. The molar mass of NaCl is 58.5g/mol.

    (iii) Assign the point groups of the molecule BF_3 and H_2O

34. (i) Write a brief note on fuel cells? (ii) State and explain Nernst equation (iii) Explain the principle of potentiometric titrations?
35. (i) What is catalysis? What are the general characteristics of catalyst? (ii) Derive an expression for rate constant of a first order reaction? (iii) Explain the influence of temperature on reaction rates?

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**IV**
COURSE	**3**
COURSE NAME	**SPECTROSCOPY AND ADVANCED MATERIALS**
COURSE CODE	**CH 1431.1**

CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students will:*	Cognitive Level
1	Discuss the principle and applications of rotational, vibrational, electronic and NMR spectroscopy.	U
2	Illustrate isomerism, geometry and bonding in co ordination complexes	A
3	Appreciate the use of co ordination compounds in qualitative and quantitative analysis	U
4	Solve numerical problems relating to nuclear chemistry	R
5	Appreciate the use of biodegradable polymers	A
6	Apply the importance energy and environment conservation	U
7	Get insight to the emerging area of nano and advanced materials	A

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I - SPECTROSCOPY 9hrs

Regions of electromagnetic spectrum – different units to represent energy such as erg, joule, calorie, cm^{-1}, Hz and eV, their interconversions – interaction of radiation with matter, different types of energy levels of molecules – rotation, vibration and electronic levels. Rotation spectroscopy Microwave spectrum of diatomic molecules – expressions for rotational energy, selection rule – frequency separation and determination of bond length – vibrational spectrum – harmonic oscillator, equation for frequency of vibration, expression for vibrational energy, selection rule, frequency separation, calculations of force constant,

Electronic spectroscopy –types of transition and regions where they absorb.

MODULE II- SPECTROSCOPY- II 9 hrs

Raman spectroscopy – stokes and anti stokes lines, quantum theory of Raman spectrum – advantages and disadvantages of Raman spectrum, rotational Raman spectrum, selection rules and frequency separation. Vibrational Raman spectrum – Complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnet, energy spacing, transition between nuclear energy levels in hydrogen nucleus, low resolutionspectrum, chemical shift, spin – spin coupling – fine structure spectrum, application to simple molecule

MODULE III COORDINATION CHEMISTRY 9 hrs

Double salts and complex salts, Werner's coordination theory, Types of ligands,
Chelating ligands- bidentate and polydentate- EDTA, Stability of chelates
Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory
Crystal field theory of octahedral and tetrahedral complexes, examples
high and low spin complexes, magnetic properties ,applications of co ordination compound in qualitative and quantitative volumetric analysis.

MODULE IV – NUCLEAR CHEMISTRY 9 hrs

Nuclear Chemistry – stability of Nucleus – n/p ratio,radioactivity, artificial transmutation and artificial radio activity. Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of pathological and genetic damage due to radiation , Dosimetry – Units – rad, gray and Roentgen. Fricke dosimeter and ceric sulphate dosimeter.

Mass defect, binding energy, atomic fission and fusion

MODULE V :CHEMISTRY OF NANO MATERIALS 9 hrs

Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc.
Nanosystems in nature.
Preparation of Nano particles – Top – down approach and bottom – top approach, sol – gel synthesis, colloidal precipitations, Co- precipitation, combustion technique.

Properties of nano particles: optical, magnetic and mechanical properties.
Tools for measuring nano structure – XRD, Atomic force Microscopy (AFM), Scanning Tunneling Microscopy (STM), and Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM) . Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, Medical applications (use Au, Ag,ZnO and ZnO_2 as examples)

MODULE VI- ADVANCED MATERIALS 9hrs

Magnetic materials-classification- applications and examples
Piezo electric and pyroelectric materials, examples
Conducting polymers- polyacetylene- ploy anilines- synthesis- applications
Bio degradable polymers: PLA, PGA and PHBV
Polymeric sulphur nitrogen compounds $(SN)_x$ as one dimensional conductors.
Photoconducting polymers-examples-super conducting materials
Liquid crystals – mesomorphic state, types of liquid crystals, applications and examples.
Ceramics: Introduction, types of clay products, properties and applications

REFERENCE

1. C.N.Banwell, Fundamentals of molecular spectroscopy, Tata Mc GRaw Hill CO. Ltd.
2. B R Puri, L R Sharma and K C Kalia, Principles of Inorganic Chemistry, Mile stone Publishers. New Delhi
3. G M Barrow, Physical Chemistry,5th Edn.Tata Mc Graw HillEducation, NewDelhi,2006
4. J E Huheey, ,E A Keiter, R L Keiter, O K Medhi, Inorganic Chemistry, 4th Edn.Pearson
5. F A Cotton and Wilkinson,Advanced Inorganic Chemistry, John Wiley, New York
6. V R Gowarikar,Polymer Chemistry, New Age International (P) Ltd. New Delhi 2010
7. T Pradeep, A Text book of Nanoscience and Nanotechnology,Mc Graw Hill, New Delhi

UNIVERSITY OF KERALA
IV Semester B.Sc Degree Examination Model Question Paper
Complementary Course for Physics Major

Course code CH1431.1 Credit 3
SPECTROSCOPY AND ADVANCED MATERIALS

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Which of the following give pure rotational spectrum: H_2, N_2, CO_2, HCl?

2. What is Rayleigh scattering?
3. What is the selection rule for vibrational transition?
4. What is the condition for a molecule to be NMR active?
5. What is Wilkinson's catalyst?
6. What is nano shells?
7. Write an example for a chelate.
8. What are the ores of titanium?
9. Name the nano meterial used in semiconductors?
10. What are ferromagnetic materials?

SECTION B

*(Answer **any eight** questions. Each question carries **2** mark)*

11. What is Born Oppenheimer approximation?
12. The force constant of HF molecule is 970Nm-1. Calculate the fundamental vibrational frequency as well as the zero point energy?
13. What is Raman Effect? What is the cause of Raman effect?
14. Explain the terms shielding and deshielding with regard to NMR spectroscopy.
15. What is chemical shift?
16. Explain the effect of solvent in UV spectroscopy.
17. What is the difference between a double salt and a complex compound?
18. $[Fe(CN)_6]^{3-}$ paramagnetic. Why?
19. Give an example for artificial transmutation of elements
20. What is half life?
21. What is STM and its basic principle?
22. Explain the synthesis of polyaniline from aniline.

SECTION C

*(Answer **any Six** questions. Each question carries **4** mark)*

23. Why are anti-stokes lines intense than the stokes lines in the Raman spectrum?
24. Taking the example of HCl show how rotation of the molecule causes dipole moment fluctuations?
25. State and illustrate the Frank-Condon principle.
26. Define the terms: Bathochromic shift, Hypsochromic shift, hyperchromic shift, hypochromic shift.
27. Discuss Werner's theory of coordination compounds.
28. Explain the formation of low spin and high spin complexes with the help of crystal field theory.
29. Write a note on Geiger Muller counter.
30. Explain the properties of nano particles.
31. Give a short note on superconducting materials.

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Derive an expression for allowed energies of rotational levels ina diatomic molecule.
    (ii) Show that for a rigid diatomic rotor the moment of inertia is given by $I= \mu r^2$.

    (iii) Discuss the quantum theory of Raman spectroscopy

33. (i) Explain the underlying principle in an NMR spectrum.
    (ii)What are the different kinds of protons indicated in an NMR spectrum. How do they produce their characteristics signals?

    (iii)How can the NMR method be used to distinguish between the structures of

    1-propanol and 2-propanol?

34. (i) Give an account of crystal field theory?
    (ii) What are applications of coordination compounds in qualitative analysis?

    (iii) Radio carbon in wood decays with a half life of 5770 years. What is the rate constant (in $year^{-1}$) for the decay? What fraction would remain after 11540 years?

35. (i) Explain the applications of nanomaterials in electronic and robotics.
    (ii) Explain working principle of SEM and TEM.

    (iii)Give a note radio active disintegration series.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF PHYSICS MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE	**5**
COURSE TITLE	**COURSE V : LAB COURSE FOR PHYSICS**
COURSE CODE	**CH 1432.1**
CREDIT	**2**

L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	COURSE OUTCOME *Upon completion of this course, the students*	Cognitive Level
1	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	E.U
2	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	A
3	Develop skill in observation , prediction and interpretation of reactions	U,A
4	Apply the principle of common ion effect and solubility product in the identification and separation of ions	A
5	Develop skill in weight calculation for preparing standard solutions	A
6	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
7	Determine physical constants	A

I. REACTIONS OF THE FOLLOWING CATIONS:

Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+},b^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^{+}.

II. SYSTEMATIC ANALYSIS OF TWO CATIONS IN A MIXTURE

The cations must be provided in solutions. A student must analyze at least ten mixtures containing two cations each.

III. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardisation of $KMnO_4$ by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

a. Standardization of sodium thiosulphate using std. potassium dichromate.

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV. GRAVIMETRIC ANALYSIS

a. Estimation of water of hydration in barium chloride crystals.

b. Estimation of barium chloride solution.

V. DETERMINATION PHYSICAL CONSTANTS (NOT FOR ESE)

a. Determination of boiling points of common solvents (b.pt range 100^0C- 130^0C)
b. Determination of melting points of organic substances (m.pt range 100^0C- 130^0C)

SYLLABUS OF COMPLEMENTARY CHEMISTRY COURSES

FOR FIRST DEGREE PROGRAMME IN GEOLOGY

Complementary Courses -4 Total Credits – 14

(One Semester – 18Weeks

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery (L)	Lab (P)			
I	2		2	CH1131.2	2x18=36
		2	-		2x18=36
II	2		2	CH1231.2	2x18=36
		2	-		2x18=36
III	3		3	CH1331.2	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.2	3x18=54
		2	4	CH1432.2	2x18=36

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students will:*	**Cognitive Level**
1	Differentiate particle nature and wave nature of matter	U
2	Associate wave concept with microscopic matter	A
3	Understand the relevance of periodic classification of elements	U
4	List various chemical bonds	R
5	Apply the VSEPR theory to explain the geometry of molecules	A
6	Comprehend the meaning of stability of nucleus	U
7	Summarise the applications of radioactivity	U
8	Relate the analytical principles while doing qualitative and quantitative analyses	E

MODULE I –ATOMIC STRUCTURE **9 Hrs**

Atomic spectrum of Hydrogen – different series, Rydberg equation

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.

Orbital wise electron configuration, energy sequence rule – Pauli's Principle, Hund's rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING **9 Hrs**

Energetics of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle - Fajan's rules.

Polarity of covalent bond -its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry.

Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.

Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3 hybridisation with examples- Explanation of bond angle in water and ammonia -

VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations- A brief review of molecular orbital approach

LCAO method – bond order, bond distance and stability of O_2, O_2^{2+}, O_2^{2-}, NO, NO^+, CO and HF.

MODULE–III: RADIOACTIVITY **9 Hrs**

Radioactive equilibrium (qualitative idea only)-

Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter –

Units of radio activity – Curie and Rutherford –

Radio Carbon dating, Rock dating, Neutron activation analysis -Applications in agriculture and medicine.

A brief study of the biological effects of radiation such as pathological and genetic damage

Dosimetry – Units – Rad, Gray ,Roentgen. Ferrous and Ceric sulphate dosimeters

Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

MODULE IV: ANALYTICAL PRINCIPLES **9 Hrs**

Analytical methods in Chemistry –

Principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis- common ion effect- solubility product- precipitation of cations

Chromatography- principle and applications of paper and thin layer chromatography.

REFERENCES

1. Manas Chanda, Atomic structure and chemical bonding with introduction to molecular spectroscopy
2. Puri, Sharma and Kalia, Inorganic chemistry-
3. E S Gilreath, Fundamental concepts of inorganic chemistry-
4. Malik,Tuli, Madan, Selected Topics in Inorganic chemistry, S Chand.
5. F A Cotton, G Wilkinson and P L Guas ,Basic inorganic chemistry-
6. Arnicker ,Elements of nuclear chemistry-
7. A I Vogel, Text book of qualitative analysis-
8. A I Vogel, Text book of quantitative inorganic analysis-
9. Day and Underwood, Quantitative analysis: Laboratory manual

UNIVERSITY OF KERALA

I Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code CH1131.2 Credit 2

THEORETICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?

6. Emission of ------ from a radioactive element does not bring any change in charge or mass.

7. What is the principle of radiocarbon dating?

8. What is the result of the beta emission of group 15 element?

9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.

10. Calculate the normality of 10% NaOH solution.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. State Hund's rule.

12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?

13. Write the Schrodinger wave equation and explain the terms?

14. NH_3 and CH_4 have sp^3 hybridization. Shapes of these molecules are different. Why?

15. Distinguish between intermolecular and intra molecular hydrogen bonding?

16. The bond energy of NO^+ is larger than that of NO. Why?

17. Define Soddy's group displacement law.

18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?

19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?

20. Phenolphthalein is not suitable for the titration of strong acid against weak base. Why?

21. How would you prepare 100ml of 0.05M Mohr's salt solution?

22. What are primary standards? Give two examples.

SECTION C

*(Answer any **six** questions. Each question carries 4 mark)*

23. Why is Bohr model of atom considered inadequate?

24. Explain hydrogen spectrum?

25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?

26. Explain the shape of SF_6 molecule.

27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.

28. Explain neutron activation analysis and its application?

29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.

30. Explain the principle and application of paper chromatography?

31. Explain the theory of redox indicators.

SECTION D

*(Answer any **two** questions. Each question carries 15 mark)*

32. (i) What are quantum numbers? Give the significance of each? (5 marks)

    (ii) Write the postulates of Bohr model of atom? (5 marks)

    (iii) Define Aufbau principle with example and explain the stability of half-filled and fully filled orbital? (5 marks)

33. (i) Write a short note on Born- Haber cycle?

    (ii) Draw and explain the MO diagram for O_2 molecule.

    (iii) Describe the different approaches of electronegativity?

34 (i) Derive an equation for the decay constant of a radioactive material.

    (ii) If at the end of 67.5 years only 3.125% of a radioactive material remains without decay. What is the half life of the decay?

    (iii) Give an example each for proton, neutron and deuteron induced reactions.

35. (i) What are acid base indicators?

    (ii) Explain the use of indicators in acid base titrations.
    (iii) Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1231.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Apply laws of thermodynamics	R
2	Relate spontaneity with entropy and free energy	E
3	Define enthalpy of reactions	R
4	Apply Hess's law	A
5	Illustrate Le Chatelier's principle and predict the effect of pressure and temperature on reactions	A
6	Categorize compounds into acids and bases	A
7	Solve numerical problems on pH and thermodynamic proprties	U,A

MODULE I –THERMODYNAMICS **9 Hrs**

First law of thermodynamics- mathematical form- intrinsic energy- enthalpy- reversible, process and maximum work- work of expansion of an ideal gas in reversible isothermal process

Heat capacity of gases at constant volume, at constant pressure, derivation of $C_P - C_V = R$

Second law of thermodynamics- entropy and free energies- significance of $\Delta G, \Delta H$ and available work – criteria of equilibrium and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation

MODULE II - THERMOCHEMISTRY **9 Hrs**

Enthalpies of formation, combustion, neutralization, solution and hydration-

Relation between heat of reaction at constant volume and constant pressure

Variation of heat of reaction with temperature- Kirchoff's equation

Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction

MODULE III – CHEMICAL EQUILIBRIUM 9 Hrs

Reversible reactions – K_P, K_C, and K_X and their inter relationships –
Free energy change and chemical equilibrium (thermodynamic derivation) –
van't Hoff reaction isotherm and isochore -
Influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2\ SO_3$

Le Chatelier's principle and the discussion of the above reactions on its basis

MODULE IV–IONIC EQUILIBRIUM 9 Hrs

Concepts of Acids and Bases-ionization of weak electrolytes-Influence of solvent on acid strength – leveling effect –
pH and its determination - potentiometric method-
Buffer solutions and calculations of the pH- Henderson equation -
Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base

REFERENCES

1. Puri, Sharma and Pathania, Principles of Physical Chemistry
2. Gurudeep Raj, Advanced physical chemistry
3. S Glastone ,Thermodynamics for chemists
4. Glastone and Lewis, Elements of Physical Chemistry
5. K L K Kapoor, A text book of Physical Chemistry
6. P C Rakshit Physical Chemistry

UNIVERSITY OF KERALA

II Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code CH1231.2 Credit 2

PHYSICAL CHEMISTRY

(2020 Admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What is a reversible process?

2. Write the first law of thermodynamics.
3. What is an isochoric process?
4. What is standard enthalpy of formation?
5. Write one example for an exothermic reaction.
6. What is enthalpy of hydration?
7. What is rate constant?
8. What is the significance of ΔG?
9. What is common ion effect?
10. What is the P^H of 0.01M HCl?

SECTION B

*(Answer **any eight** questions. Each question carries **2** marks)*

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?
12. State the first law of thermodynamics. What are its limitations?
13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?
14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) $\longrightarrow$ C_2H_6 (g).Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.
15. Define Enthalpy of formation.
16. What is bond dissociation energy?
17. State Le Chatlier principle.
18. What is isochoric process?
19. What are the characteristics of equilibrium constant?
20. Define Lewis acid and base.
21. What is meant by levelling effect?
22. What is ionic product of water?

SECTION C

*(Answer **any six** questions. Each question carries **4** mark)*

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?

26. State and explain Hesse's law.

27. Derive relation between heat of reaction at constant volume and constant pressure.

28. Calculate the equilibrium constant for a reaction at 25^0C. ΔG^0=20kcal.

29. Predict the effect of pressure on the dissociation of PCl_5.

30. What is meant by Buffer solution? Give an example of acidic and basic buffer solution? Explain its mechanism?

31. Write Henderson equation. What is its significance?

SECTION D

*(Answer **any two** questions. Each question carries **15** mark)*

32. (i) Derive an expression for work done in the reversible isothermal expansion of an ideal gas.

    (ii) Define

    (a) Work function

    (b) Gibbs free energy function

    (c) Entropy

    (d) Internal energy

33. (i) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.

    (ii) Calculate the heat of formation of CO_2. Given that CO (g)+H_2O (l) $\Longleftrightarrow$ CO_2 (g)+ H_2(g); ΔH=0.7 kcal. Heat of formation of H_2O (l) and CO (g) are -68.3 and -26.4 kcalmol^{-1} respectively.

34. (i) Derive van't Hoff equation.

    (ii) Derive relation between Kp and Kc.

    (iii) The equilibrium constant of a reaction doubles on raising the temperature from 25^0C to 35^0C. Calculate ΔH^0 of the reaction?

35. (i) Define pH of a solution. Calculate the pH of 0.2M acetic acid in 0.5M sodium acetate at 298K. Dissociation constant of acetic acid at 298K is 1.8 x10^{-5}?

    (ii) Write a note on salt hydrolysis?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	III
COURSE	3
COURSE TITLE	PHYSICAL AND INORGANIC CHEMISTRY
COURSE CODE	CH1331.2
CREDIT	3
L-T-P	3-0-2
TOTAL HOURS	54

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Understand gaseous state	U
2	Interpret the deviation of real gases from ideal behaviour	U & E
3	Get an insight on crystal structure	A
4	Draw and Make crystal models of NaCl & KCl crystals	C
5	Understand chemical cycles of Carbon, Sulphur, Nitrogen and Phosphorous	U
6	Comprehend the properties of various anions, in particular, oxides	A
7	Differentiate true solution, colloidal solution and suspension	E
8	Understand the properties of colloids and their application	U

MODULE I – GASEOUS STATE (9 Hrs)

Maxwell's distribution of molecular velocities (no derivation), average, most probable and RMS velocities

collision number and collision frequency, mean free path

deviation of gases from ideal behaviour – Boyle temperature, derivation of Vander Waal's constants and critical constants

Law of corresponding states – reduced equation of state,

Joule Thomson coefficient, liquefaction of gases –Linde's and Claudes process.

MODULE II –CRYSTALLINE STATE (9 Hrs)

Isotropy and anisotropy – symmetry elements in crystals –

seven crystal systems – Miller indices, Bravais lattices, primitive, bcc and fcc lattices of cubic crystals

Bragg equation - diffraction of X rays by crystals – single crystal and powder method

Detailed study of structure of NaCl and KCl crystals

Liquid crystals – mesomorphic state, types of liquid crystals, application and examples

MODULE III– CHEMICAL CYCLES AND GROUP PROPERTIES (9 Hrs)

Carbon, Sulphur, Nitrogen, Phosphorous and hydrologic cycle

Group properties (reactions) of anions in common minerals – Carbonate, Sulphate, Phosphate, Sulphides and Fluorides

Classification of oxides – Acidic, Basic, Amphoteric and neutral

MODULE IV: SURFACE CHEMISTRY AND COLLOIDS (9 Hrs)

Adsorption – types of adsorption of gases by solids, factors influencing adsorption, Freundlich adsorption isotherm – Langmuir adsorption isotherm (derivation not required)

Colloids- True solution, colloidal solution and suspension

Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples

Purification of colloids by electro dialysis and ultra filtration

Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis

Origin of charge and stability of colloids – Coagulation - Hardy Schulze rule – Protective colloids - Gold number

Emulsions- Applications of colloids: Cottrell precipitator – purification of water, coagulation, reverse osmosis, electro dialysis, delta formation, medicines, cleaning action of detergents and soaps.

MODULE V INORGANIC POLYMERS (9 Hrs)

General properties of inorganic polymer-

phosphazenes – preparation of linear and cyclo phosphazene with examples, properties, and application

silicones – general methods of preparation and properties examples

applications of Silicones, Silicone rubber, silicone resins

MODULE VI SOIL AND WATER CHEMISTRY (9 Hrs)

Soil – Composition, mineral matter in soil process of soil formation, weathering – physical (mention), chemical (detail) + biological (mention)

Saline and alkaline soil (brief explanation) Rocks – different types (Igneous, sedimentary and Metamorphic.)

Analysis of lime stone qualitative treatment only

Water Analysis Water quality parameters COD, BOD, main quality characteristics of water (alkalinity, hardness, total solids and oxidation)

Water treatment including chemical (Precipitation, aeration, osonisation, chlorination) and physical methods of sterilization

REFERENCES

1) Rakshit Physical Chemistry
2) Puri,Sharma, Pathania Principles of Physical Chemistry
3) B.K.Sharma, Instrumental methods of Chemical Amalysis
4) Vogel's Text book of Quantitative Chemical Analysis –VI Edition

5) Manas Chanda, Atomic structure with introduction to Molecular Spectroscopy
6) N.M.Kapoor, Physical Chemistry-
7) B.K.Sharma, Soil and Noise pollution-
8. B.K.Sharma, Industrial Chemistry

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary Course for Geology Major

Course Code: CH1331 .2 Credit 3

(2020 Admission onwards)

PHYSICAL AND INORGANIC CHEMISTRY

Time: Three Hours **Maximum marks: 80**

SECTION A

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

1. Write the general formula of silica.
2. How oxides are classified?
3. Explain the term mean free path.
4. Name two classification of colloids based on solvent?
5. Explain Bravais lattices
6. Write the expression for RMS velocity.
7. What is inorganic rubber?
8. Define Brownian movement.
9. Define glass transition temperature.
10. Mention any two chemical methods of water sterilization.

SECTION B

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

11. Distinguish between most probable velocity and average velocity.

12. State law of corresponding states.
13. Differentiate between isotropy and anisotropy.
14. Find the Miller indices of a crystal plane with intercepts 2a,2b and 3c.
15. Explain COD and BOD.
16. How will you analyse limestone qualitatively?
17. What is CMC
18. Draw Langmuir adsorption isotherm
19. What is the difference between colloid and suspension?
20. Define Boyle temperature.
21. What is Bragg's equation?
22. What is Joule- Thomson coefficient?

SECTION C

(Answer any six questions. Each question carries 4 marks)

23. What are the causes for the deviation of real gases from ideality? How is it solved?
24. Explain symmetry elements in crystals.
25. Give an account of weathering with emphasis to chemical weathering.
26. What are inorganic polymers? How do they differ from organic polymers?
27. Give any one method for the preparation of silicones. What are the important applications of silicones?
28. Explain Hardy Schulze rule with the help of an example.
29. Give an account of carbon cycle.
30. Explain Linde's process of liquefaction of gases.

SECTION D

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

31. (a) Explain liquid crystals with examples for each type (b) Give a detailed account on the structure of NaCl.
32. Write a note on (a) Nitrogen cycle (b) different types of rocks and (c) main quality characteristics of water.
33. Give an account of the preparation, properties and important applications of (a) silicates (b) phosphazenes.

34. (a) Write a note on different types of adsorption of gases by solids.

(b) Describe the applications of colloids.

35. (a) Write a short note on the various purification methods of water.

(a) Calculate the average velocity and root mean square velocity of a molecule in a sample of oxygen at 0 °C?

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	IV
COURSE	4
COURSE NAME	PHYSICAL AND ANALYTICAL CHEMISTRY
COURSE CODE	CH 1431.2
CREDIT	3
L-T-P	3-0-2
TOTAL HOURS	54

CO No.	**COURSE OUTCOME** ***Upon completion of this course, the students:***	**Cognitive Level**
1	Discuss metallurgy and metallurgical processes	U

2	Get and insight in to petro chemical industry	U
3	Explain the reaction kinetics	A
4	Understand the theories of catalysis	U
5	Couple different electrode and construct electrochemical cells	U
6	Appreciate the use of sophisticated instruments	A

MODULE I -METALLURGY **9 Hrs**

Occurrence of metals, General principles of extraction of metals from their ores:

Concentration of ores- roasting, calcinations and smelting

General methods of extracting metal from concentrated ore Electrometallurgy and Pyrometallurgy

Refining of metals : electrolytic and zone refining only.

Metallurgy of Titanium, Iron, cobalt, Nickel, Thorium, Uranium

Extraction of lanthanides

MODULE II- PETRO CHEMICALS **9 Hrs**

Introduction to crude oil, exploratory methods, constitution of crude oil, natural gas – constituents

Distillation of crude oil, separation of natural gas and different fractions

Meaning of terms such as ignition point, flash point, octane number

Types of hydrocarbon fuels and their characteristics

Cracking – catalytic cracking, hydro cracking, isomerization, reforming, sulphur, hydrogen, petroleum, coke and nitrogen compounds from petroleum.

MODULE III - CHEMICAL KINETICS **9 Hrs**

Rates of reactions, various factors influencing rates of reactions

order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory of rates

MODULE IV- CATALYSIS AND PHOTO CHEMISTRY 9 Hrs

Theories of catalysis, outline of intermediate compound formation theory and adsorption theory

Photo Chemistry- Laws of photo Chemistry -Grotthus Draper Law, Einstein's law, Beer lambert law

Photo Chemical equivalence and quantum yield, explanation for high and low quantum yields, H_2-Cl_2 reaction, H_2-Br_2 reaction

Photosensitization and Chemiluminescence

MODULE V- ELECTRO CHEMISTRY 9 Hrs

Transport number – definition, determination by Hittorffs method and moving boundary method, application of conductance measurements

Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode

Standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode, concentration cell without transference, Potentiometric titration

Fuel cells – H_2 – O_2 and hydrocarbon – O_2 type

MODULE VI- INSTRUMENTAL METHODS OF ANALYSIS 9 Hrs

Spectral methods – Atomic Absorption Spectroscopy (AAS) principle, measurement, advantages, disadvantages, and applications

Flame Emission Spectroscopy (FES) principle, measurement,(single beam method) applications

Thermal methods: Themogravimetric analysis (TG) principle and method, Factors affecting thermogravimetric analysis, Application, Differential Thermal Analysis (DTA),

principle, method, factors affecting DTA, Applications

REFERENCES

1. Rakshit Physical Chemistry
2. Puri,Sharma, Pathania Principles of Physical Chemistry
3. B.K.Sharma Instrumental methods of Chemical Analysis
4. Vogel's Text book of Quantitative Chemical Analysis –VI Edition
5. Manas Chanda Atomic structure with introduction to Molecular Spectroscopy
6. N.M.Kapoor, Physical Chemistry
7. B.K.Sharma,Industrial Chemistry

Model Question Paper Chemistry (complementary) for Geology majors

Semester IV Course Code: CH1431.2 Course IV Credit 3

(2020 admission onwards)

PHYSICAL AND ANALYTICAL CHEMISTRY

Time: Three Hours **Maximum marks: 80**

SECTION A

Answer all questions. Each question carries 2 marks

1. Write Arrhenius equation.
2. State Beer Lambert law.
3. Explain catalytic cracking.
4. Give an example of a negative catalyst with the chemical reaction which it catalyses.
5. The rate law for a reaction is $r = k [A] [B]^2$. Write the order of the reaction.
6. Define octane n u m b e r .
7. Name two important ores of Uranium.
8. Draw the shape of graph for the titration of a strong acid Vs strong base.
9. What you meant by flash point?
10. Conductance of an electrolyte depends on ……. and ……..

SECTION B

Answer any eight questions. Each question carries 2 marks

11. What is the influence of temperature on reaction rate?
12. A substance decomposes following first order kinetics. The half life period of the reaction is 35 minutes. What is its rate constant?
13. State Einstein's law of photochemical equivalence.
14. Define quantum yield of a photochemical reaction.
15. Explain van't Hoff reaction isotherm.
16. Illustrate SHE.

17. Write the principle of AAS.
18. How do you differentiate a TG curve from a DTA curve?
19. What is smelting.
20. Distinguish between order and molecularity?
21. What is Grotthus- Draper law?
22. Explain chemiluminescence.

SECTION C

Answer any six questions. Each question carries 4 marks

23. Give the Arrhenius equation. How will you determine the Arrhenius parameters?
24. Explain photosensitization reaction with an example.
25. Explain the method used to determine transport number of an electrolite.
26. What is the principle of flame emission spectroscopy? Mention its important applications.
27. What are the general methods for refining of metals?
28. Give an account of different types of hydrocarbon fuels and their characteristics.
29. Distinguish between isotherm and isochors.
30. Explain quantum yield in terms of H_2-Cl_2 reaction.

Section D. Answer any two questions. Each question carries 15 marks

31. (a) Derive the expression for the rate constant of a first order reaction. (b) How will you express the units of rate constant for reactions of order 1, 2 and 3?
32. Write a note on (a) Extraction of lanthanides (b) Types of hydrocarbon fuels and their characteristics (c) Photosensitization.
33. Give a detailed account on the principle and applications of (a) TG and (b) DTA.
34. (a) Discuss the principle, measurement and applications of Flame Emission Spectroscopy (FES) (b) Explain Collision theory of rates.
35. (a)Explain the method used to determine transport number of an electrolyte.

    (b) A solution of silver nitrate containing 12.14 g of silver in 50 ml of solution was electrolysed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, while 1.25 g of metallic silver was deposited on the cathode. Calculate the transport number of Ag^+ and NO_3^- ions.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF GEOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE	**5**
TITLE	**COURSE V : LAB COURSE FOR GEOLOGY**
COURSE CODE	**CH 1432.2**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** ***Upon completion of this course, the students***	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	A
	Develop skill in observation , prediction and interpretation of reactions	A
	Apply the principle of common ion effect and solubility product in the identification and separation of ions	A
	Develop skill in weight calculation for preparing standard solutions	U,E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Determine pH of soil and water samples	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR GEOLOGY MAJORS)

Course Code CH1432 .2 Credit 2

Ⅳ. REACTIONS AND ANALYSIS OF CATIONS : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+},b^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^{+}.

The cations must be provided in solutions. A student must analyze at least ten mixtures containing two cations each.

II. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardisation of $KMnO_4$ by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. **Iodometry and Iodimetry**

a. Standardization of sodium thiosulphate using std. potassium dichromate.

b. Estimation of copper in a solution

c. Estimation of iodine

E. **Complexometric titrations**

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

III. GRAVIMETRIC ANALYSIS

IV. Estimation of water of hydration in barium chloride crystals.

b. Estimation of barium chloride solution.

IV. pH DETERMINATION (NOT FOR ESE)

Measurement of pH of soil and water samples using pH meter.

COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

Complementary Courses -4 Total Credits – 14

(One Semester – 18Weeks)

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.3	2x18=36
		2	-		2x18=36
II	2		2	CH1231.3	2x18=36
		2	-		2x18=36
III	3		3	CH1331.3	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.3	3x18=54
		2	4	CH1432.3	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR STUDENTS OF BOTANY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**2**
COURSE TITLE	**ANALYTICAL AND ENVIRONMENTAL CHEMISTRY**
COURSE CODE	**CH1131.3**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students* **,**	**Cognitive Level**
1	Discuss Bohr atom model and represent electronic configuration of elements	U
2	Predict structure of simple molecules based on the concept of hybridisation	A
3	Identify hydrogen bonding in relation to physical and chemical properties	U
4	List the various chemical bonds	R

5	Apply the VSEPR theory to explain the geometry of molecules	A
6	Discuss the theory of volumetric analysis	U
7	Become aware of threat of chemical pollutants air ,water and soil	A

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –ATOMIC STRUCTURE (9 Hrs)

Atomic spectrum of Hydrogen – different series, Rydberg equation

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.

Orbital wise electron configuration, energy sequence rule – Pauli's Principle, Hund's rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING (9 Hrs)

Energetics of bond formation –Born Haber cycle

Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3 hybridisation with examples- Explanation of bond angle in water and ammonia

VSEPR theory with regular and irregular geometry

Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility

Partial covalent character of the ionic bond- Fajan's rules-

A brief review of molecular orbital approach-

LCAO method – bond order, bond distance and stability of O_2, O_2^{2+}, O_2^{2-}, NO, NO^+

MODULE III: ANALYTICAL PRINCIPLES (9 Hrs)

Principles of volumetric analysis- primary standard - standard solutions- normality and molarity - theory of acid - base titrations, permanganometric and dichrometric titrations, iodometric and complexometric titrations-

Theory of acid – base and redox indicators-

Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate

MODULE IV – ENVIRONMENTAL CHEMISTRY (9 Hrs)

Nature of environmental threats and role of chemistry-

Green house effect, ozone layer and its depletion-

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis

Dissolved oxygen-BOD, COD

Text Books / References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, "Text book of Qualitative Analysis"
6. A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
7. S. K. Banerji, "Environmental Chemistry".
8. A. K. De "Environmental Chemistry - An introduction"
9. B. K. Sharma "Air Pollution".
10. V. K. Ahluwalia "Environmental Chemistry"
11. G.W. van Loon and S. J. Duffy "Environmental Chemistry: A global perspective"

UNIVERSITY OF KERALA
First semester B.Sc Degree Examination Model question paper
Complementary course for Botany Majors

Course Code CH1131.3 Credit 2

(2020 admission onwards)

ANALYTICAL AND ENVIRONMENTAL CHEMISTRY

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is Bohr Bury's rule?

12. Write down the Schrodinger Equation and explain the terms involved.

13. Explain the failures of Bohr's theory?

14. What are the limitations of VSEPR Theory?

15. What are polar and non polar covalent bonds?

16. Mention the rules for adding electrons to molecular orbitals?

17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?

19. Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20. Which are the green house gases? Mention their sources.

21. What is reverse osmosis? How it is useful in the purification of waste water?

22. What are chief factors responsible for water pollution?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol-1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?

24. Explain the stability of half filled and completely filled orbitals.

25. Give an account of permanganometric titrations.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Born-Haber Cycle considering the formation of NaCl as an example.

30. Write a note on agricultural pollution.

31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION D

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

32. (a) Discuss Bohr Theory, highlighting its merits and demerits.

    (b)What are quantum numbers? Give its significance.

    (c) Explain various rules regarding electronic configuration.

33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

    (b) Explain the theory of redox indicators.

    (c) Explain Beer's Law, Lambert's Law and Beer – Lambert Law.

34. (a) Write a note on Hydrogen bonding and its consequences.

    (b) How electronic configuration of molecules related to molecular behavior? Explain.

    (c) Explain Fajan's Rule.

35. (a) Discuss the formation and importance of ozone layer.

    (b) What is meant by pollution and pollutants? Explain the classification of air pollutants.

    (c) What are the sources of important air pollutants?

UNIVERSITY OF KERALA

Complementary Chemistry for Botany Majors

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**INORGANIC & BIOINORGANIC CHEMISTRY**
COURSE CODE	**CH1231.3**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Understand the biological and environmental aspects of organic compounds	U
2	Comprehend the meaning of stability of nucleus	R
3	Summarise the applications of radioactivity	U
4	Predict the properties of transition metal complexes	A
5	Apply complexation reactions in qualitative and quantitative analysis	U

6	Appreciate biological processes like photosynthesis, respiration etc	E
7	Realise the use of trace elements in biochemical processes	A

R-Remember, U-Understand, A-Apply, E-Evaluate

MODULE I :ORGANOMETALLICS (9 Hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications

Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses

Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture

Environmental aspects of Organometallic compounds

MODULE II NUCLEAR CHEMISTRY (9 Hrs)

Natural radioactivity, modes of decay, Geiger–Nuttal rule-

Artificial transmutation and artificial radioactivity-

Nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion-

Applications of radioactivity- ^{14}C dating, rock dating, neutron activation analysis and isotope as tracers

MODULE III - COORDINATION CHEMISTRY (9 Hrs)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism

Valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes

Application of metal complexes in qualitative and quantitative analysis

MODULE IV – BIO INORGANIC COMPOUNDS (9 Hrs)

Metalloporphyrins – cytochromes –

Chlorophyll - photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of O_2 – CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

TEXT BOOKS /REFERENCES

1. Bosolo and Johns, Co-ordination Chemistry
2. Rochoco,Chemistry of Organometallics
3. J.D. Lee ,Concise Inorganic Chemistry
4. Puri, Sharma and Kalia, "Inorganic Chemistry"
5. A.D. Madan ,Modern Inorganic Chemistry

II Semester B.Sc Degree Examination Model question paper

Complementary Course for Botany Majors

Course Code CH1231.3 Credit 2

INORGANIC AND BIOINORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Give the structure of Zeisel's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of $K_3[Co(NO_2)_4Cl_2]$
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?

14. Explain Geiger Nuttal Rule.

15. What are half life period and average life period?

16. Define mass defect and binding energy.

17. Write the postulates of Werner's Coordination Theory.

18. What are poly dentate ligands? Give an example.

19. Explain the colours of transition metal complexes.

20. Differentiate respiration and photosynthesis.

21. What are trace elements?

22. What is the role of chlorophil in photosynthesis?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Write a note on organotin compounds.

24. Write a brief note on the applications of organometallic compounds in agriculture and horticulture.

25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?

26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss briefly the biochemistry of iron toxicity and nutrition.

31. Metal ions play a variety of roles in biological systems. Explain.

SECTION D

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

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)

(b) What are Frankland reagents? Give its significance. (5 marks)

(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)

(b) Give the principle of neutron activation analysis. (5 marks)

(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5 marks)

(c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

UNIVERSITY OF KERALA

COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**4**
COURSE TITLE	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1331.3**

CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Classify reactions on the basis of order and molecularity	A
2	Understand the effect of temperature on reaction rates	U
3	Understand the theories of catalysis	U
4	Categorize compounds into acids and bases	U
5	Discuss the principle and application of UV and NMR spectroscopy.	U & A
6	Understand the properties of colloids and their application	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I - CHEMICAL KINETICS **9 Hrs**

Rates of reactions, various factors influencing rates of reactions

order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory

Catalysis- Different types of catalysis- intermediate compound formation theory and adsorption theory

MODULE II–IONIC EQUILIBRIUM **9 Hrs**

Concepts of Acids and Bases-ionization of weak electrolytes-Influence of solvent on acid strength – leveling effect –

pH and its determination - potentiometric method-

Buffer solutions and calculations of the pH- Henderson equation -

Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid - strong base and weak acid – weak base

MODULE II–SOLUTIONS **9 Hrs**

Completely miscible liquid pairs, vapour pressure - composition curve, boiling point-composition curve- ideal and non ideal solutions, fractional distillations, azeotropes

Partially miscible liquids - CST, phenol- water, nicotine-water system- Effect of impurities on miscibility and CST,

Immiscible liquid pairs, steam distillation- Distribution law and its limitations, applications of solvent extractions.

MODULE IV - UV AND NMR SPECTROSCOPY **9 Hrs**

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation-

Concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects.

UV-Visible spectra of enes - Calculation of λmax

Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH

Principle of MRI

MODULE V DILUTE SOLUTIONS **9 Hrs**

Molarity, molality and mole fraction

Colligative property – relative lowering of vapour pressure – elevation in boiling point – depression in freezing point – osmotic pressure – experimental determination of osmotic pressure – Isotonic solution – reverse osmosis - abnormal molecular mass - van't Hoff factor.

(Numerical Problems to be worked out)

MODULE VI COLLOIDS- **9 Hrs**

Colloidal state- Types of colloids

Preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids

Ultra microscope, Electrical double layer and zeta potential

Coagulation of colloids, Hardy-Schulz rule

Micelles and critical micelle concentration, sedimentation

Application of colloids – Cottrell precipitator, purification of water and delta formation

REFERENCES

1. Chatwal,Gurdeep.R Organic Chemistry of Natural Products, , Himalaya Publications
2. Puri Shrama Pathania Principles of Physical chemistry, , Vishal
3. P.S. Kalsi,Chemistry of natural products, New Age International Private Ltd
4. Y.R Sharma, Elementary organic spectroscopy, S chand & Company
5. B.R.Puri, R.L.Sharma & Pathania Principles of Physical Chemistry, Vishal Publishing
6. B.S. Bahl., G.D. Tuli & Arun Bahl ,Essentials of Physical Chemistry, , S.Chand & Co., N Delhi.
7. R.L. Madan, G.D. Tuli Simplified Course in Physical Chemistry, , S.Chand & Co.
8. B.K .Sharma ,Chromatography, GOEL Publishing house, Meerut

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary course for Botany Majors

Course Code CH1331.3 Credit 3

PHYSICAL CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define pH.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift.
7. Explain chromophore with an example.
8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Define Van't Hoff factor.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constant of a chemical reaction on the absolute temperature and explain the terms involved.
13. Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?

15. What is critical micelle concentration? Discuss the structure of micelles in polar and non polar media
16. Tetra Methyl Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Differentiate between molarity and molality.
19. A solution containing 7g of a non volatile solute in 250g of water boils at 373.26 K. Find the molecular mass of the solute.(Kb for water is 0.52K/m)
20. Explain the terms: Degree of hydrolysis and hydrolysis constant.
21. Explain reverse osmosis.
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst?
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31x10^{-3}$ s^{-1}. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = $1.85x10^{-5}$.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electro-dialysis techniques used for the purification of colloids
29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$
30. What is osmotic pressure? How will you determine the molecular mass of a substance with this method?
31. Explain the principle of Fractional Distillation

SECTION D

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

32. (a)Differentiate between Molecularity and order of a reaction with examples (5 marks)

    (b) Discuss the Kinetic, optical and electrical properties of colloids (5 marks)

    (c) Explain the protective action of colloids(5 marks)

33. (a) Which of the following has the highest osmotic pressure: 0.1M sucrose, 0.1M acetic acid, 0.1M KCl and 0.1M Na_2SO_4 all in water? Why?

(b) Why do you get abnormal molecular masses of the substances by using colligative properties of the solution.

(c) Discuss in detail about the determination of molecular mass of a non volatile compound from elevation in boiling point and depression in freezing point

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples.

(b) Define critical solution temperature. Explain systems having upper and lower CST using examples

(c) Explain the applications of UV spectroscopy

35. (a) Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.

(b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR spectrum of ethanol molecule.

UNIVERSITY OF KERALA

Complementary Chemistry for Botany Majors

SEMESTER	**IV**
COURSE TITLE	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1431.3**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Discuss the principle and applications of chromatography and electrophoresis	U
2	Classify amino acids, proteins, carbohydrates and vitamins. Identify and distinguish the structure of amino acids, peptides, proteins and nucleic acids.	U
3	Summarise the concept of optical isomerism.	U and A
4.	Categorise crude drugs and explain the method of evaluating crude drugs.	U
5.	Draw the structure of aminoacids, carbohydrates, simple optical isomers	R
6.	Explain the preparation and reactions of amino acids and carbohydrates	U
7.	Discuss the extraction process and general properties of natural products -oils, fats, terpenes and alkaloids.	U

*R-Remember, U-Understand, A-Apply

MODULE I - CHROMATOGRAPHY **9 Hrs**

Outline study of adsorption and partition chromatography-

Principle and applications of paper, thin layer, ion exchange and gas chromatography

Principle, instrumentation and applications of HPLC

Rf and Rt value of various chromatographic techniques

Electrophoresis – Principle and application of Zone and Capillary electrophoresis

MODULE II - STEROCHEMISTRY **9 Hrs**

Optical Isomerism : Chirality and elements of symmetry; DL notation and Enantiomers

Optical isomerism in glyceraldehydes, lactic acid and tartaric acid

Diastereoisomers and mesocompounds

Cahn-Ingold-Prelog rules – R-S notations for optical isomers with one and two asymmetric carbon atoms

Racemic mixture, resolution and methods of resolution

MODULE III - AMINO ACIDS AND PROTEINS **9 Hrs**

Amino acids: - Classification, structure and stereochemistry of amino acids Essential and non essential amino acids, zwitter ion, isoelectric point

General methods of preparation and reactions of amino acids

Peptides: structure and synthesis-Carbobenzoxy and Sheehan method

Proteins: - Structure of proteins, denaturation and colour reactions

Nucleic acids: - Classification and structure of DNA and RNA- Replication of DNA, Genetic Codes-Translation- Transcription

MODULE IV - OILS, FATS, ALKALOIDS, VITAMINS AND TERPENES 9 Hrs

Oils and Fats: Occurrence and extraction-Analysis of oils and fats-saponification value, iodine value and acid value

Alkaloids: - Extraction and structural elucidation of conine and importance of quinine, morphine and codeine

Terpenes: Classification- Isoprene and special isoprene rule-Isolation of essential oils-

citral and geraniol (No structural elucidation)

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

MODULE V - CARBOHYDRATES 9 Hrs

Classification- Configuration of glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose

Preparation and properties of glucose and fructose (oxidation, reduction and reaction with phenylhydrazine only)

Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected)

Mutarotation and epimerization- Conversion of glucose into fructose and viceversa

Structure of starch and cellulose (structure elucidation not expected)

MODULE VI - PHYTOCHEMICALS AND CRUDE DRUGS 9 Hrs

Pharmacognacy – Scope and importance, scheme for pharmacognotic studies of crude drugs

Phytochemicals. Crude drugs: Morphological, pharmacological and chemical classification

Collection and processing of crude drugs – collection and harvesting, drying, garbling, packing

Processing of drugs: Method of preparation – decotion, maceration and infusion

Methods of drug evaluation: Moisture content, volatile content, solubility, optical rotation, ash values and extracting, spectroscopic analysis, chromatographic method and foreign organic matter (Mention only)

Phytoconstituents of therapeutic values: Carbohydrates, glycosides (saponin glycosides and cardiac glycosides), alkaloids (quinoline, isoquinoline, indole alkaloids and steroidal alkaloids) volatiles oils and phenols (Mention its sources, important compounds in each class and therapeutic importance)

Text Books / References

1. Organic Chemistry of Natural Products, Chatwal, Gurdeep.R, Himalaya Publications
2. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd

3. Chromatography, .B.K .Sharma, GOEL Publishing house, Meerut
4. Pharmacognosy, A.Roseline, MJP publishers, 2011.
5. A textbook of Organic Chemisty, K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, Vikas Publishing House (Pvt) Ltd., New Delhi.
6. Modern Organic Chemistry, S.C.Sharma and M.K.Jain, Vishal Publishing Company, New Delhi.
7. Stereochemistry of Organic Compounds: Principles and Applications, D.Nasipuri, New Age International Publizhers, New Delhi.

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Botany Majors

Course Code CH1431.3 Credit 3

ORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What is meant by Rf value?
2. Define Racemic mixture.
3. Represent the configurations of D and L glyceraldehyde.
4. Give two examples of essential amino acids.
5. Describe a colour test for proteins.
6. Define Iodine value.
7. Name a phytochemical.
8. State Special isoprene rule?
9. Write an example for volatile oil .
10. Give the deficiency disease of Vitamin C.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Give the principle of adsorption chromatography.
12. What is meant by denaturation of proteins.
13. Discuss the importance of Morphine.
14. Which of the following are optically active ? Why?

    (i) 2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane
15. Give four differences between enantiomers and diastereoisomers.
16. Write a note on the different types of RNA and its functions.
17. How are alkaloids extracted from natural sources?
18. Give the classification of Vitamins.
19. What happens when glucose is treated with Br_2 water?
20. Define moisture content and extraction value.
21. Name four anticancer compounds from plants.
22. Explain saponification.

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Discuss the optical isomerism of tartaric acid.
24. Write a note on DNA replication.
25. Give the synthesis of Tryptophan.
26. Comment on zwitter ion and isoelectric point.
27. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
28. Give a brief account on Thin Layer Chromatography.
29. Write a note on the methods of isolation of terpenoids.
30. Describe the structure of starch and cellulose.
31. Mention the source and therapeutic value of the alkaloid phytoconstituent.

SECTION D

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

32. (a)Explain Ion exchange Chromatography.

    (b)Elucidate the structure of Coniine.

(c)Describe the structure of DNA.

33. (a)Discuss briefly the structure of Protein.

    (b)Explain Sheehan's method of peptide synthesis.

    (c)What are crude drugs? Discuss its classification

34. (a)What is resolution? Explain any three methods of resolution.

    (b)What are meso compounds? Are they optical active? Explain with a suitable example.

    (c)Discuss the isolation, structure and uses of geraniol.

35. (a) Diffrenciate mutarotation and epimerization

    (b) Define Oils and fats and discuss the different methods of extraction.

    (c)Discuss on the pyranoside structure of glucose and furanoside structure of fructose.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF BOTANY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR BOTANY**
COURSE CODE	**CH 1432.3**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	COURSE OUTCOME *Upon completion of this course, the students*	Cognitive Level
1	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
2	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
3	Develop skill in observation, prediction and interpretation of reactions	U,A
4	Prepare organic compounds, Purify and recrystallise	U,A
5	Develop skill in weight calculation for preparing standard solutions	E,A
6	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
7	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR BOTANY MAJORS

Course Code CH1432 .3 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- cresol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters

COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

This Complementary Course has 4 theory courses and 4 practical courses. The Hour allotments and Credits for all are given in the table.

COMPLEMENTARY COURSES -4

TOTAL CREDITS – 14

ONE SEMESTER =18 WEEKS

Semester	Hours per week		Number of Credits	Course Code	Instructional Hours
	Theory	Lab			
1	2	2	2	CH1131 .4	2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .4	2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .4	3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .4 CH1432 .4	3×18 =54 2×18 = 36

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SYLLABUS OF COMPLEMENTARY COURSE

FOR STUDENTS OF ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.4**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Differentiate particle nature and wave nature of matter	U
2	Associate wave concept with microscopic matter	A
3	Understand the relevance of periodic classification of elements	U
4	Descibe the various tupes of chemical bonds	R
5	Apply the VSEPR theory to explain the geometry of molecules	E,A
6	Comprehend different segments of titrations	U

7	Apply the principles of colorimetry to estimate ions and elements	A
8	Recognize the factors affecting environment and solutions for it	E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I –ATOMIC STRUCTURE **9 Hrs**

Atomic spectrum of Hydrogen – different series, Rydberg equation

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (no derivation, mention only) - concept of orbitals, the four quantum numbers and their significances.

Orbital wise electron configuration, energy sequence rule – Pauli's Principle, Hund's rule, stability of filled and half filled orbitals

MODULE II - CHEMICAL BONDING **9 Hrs**

Energetics of bond formation –Born Haber cycle

Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2, and sp^3d^3

hybridisation with examples- Explanation of bond angle in water and ammonia

VSEPR theory with regular and irregular geometry

Hydrogen bond – inter and intra molecular – its consequences on boiling point –volatility and solubility

Partial covalent character of the ionic bond- Fajan's rules-

A brief review of molecular orbital approach-

LCAO method – bond order, bond distance and stability of O_2, O_2^{2+},O_2^{2-},NO,NO^+

MODULE III: ANALYTICAL PRINCIPLES **9 Hrs**

Principles of volumetric analysis- primary standard - standard solutions- normality and molarity - theory of acid - base titrations, permanganometric and dichrometric titrations, iodometric and complexometric titrations-

Theory of acid – base and redox indicators-

Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate

MODULE IV – ENVIRONMENTAL CHEMISTRY **(9 Hrs)**

Nature of environmental threats and role of chemistry-

Green house effect, ozone layer and its depletion-

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis

Dissolved oxygen-BOD, COD

Text Books / References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De
4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, "Text book of Qualitative Analysis"
6. A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
7. S. K. Banerji, "Environmental Chemistry".
8. A. K. De "Environmental Chemistry - An introduction"
9. B. K. Sharma "Air Pollution".
10. V. K. Ahluwalia "Environmental Chemistry"
11. G.W. van Loon and S. J. Duffy "Environmental Chemistry: A global perspective"

I Semester B.Sc Degree Examination Model question paper
Complementary course for Zoology Majors
Course Code CH1131.4 Credit 2
THEORETICALCHEMISTRY
(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H2 molecule.
5. Give the structure of XeO3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is Bohr Bury's rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr's theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?

16.Mention the rules for adding electrons to molecular orbitals?

17.What are dichrometric titrations?

18.How would you prepare 100ml of 0.05M Mohr's salt solution?

19.Why is methyl orange not a suitable indicator for the titration of weak acid with strong base?

20.Which are the green house gases? Mention their sources.

21.What is reverse osmosis? How it is useful in the purification of waste water?

22.What are chief factors responsible for water pollution?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol-1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION D

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

32. (a) Discuss Bohr Theory, highlighting its merits and demerits.

    (b)What are quantum numbers? Give its significance.

(c) Explain various rules regarding electronic configuration.

33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.

(b) Explain the theory of redox indicators.

(c) Explain Beer's Law, Lambert's Law and Beer – Lambert Law.

34. (a) Write a note on Hydrogen bonding and its consequences.

(b) How electronic configuration of molecules related to molecular behavior? Explain.

(c) Explain Fajan's Rule.

35. (a) Discuss the formation and importance of ozone layer.

(b) What is meant by pollution and pollutants? Explain the classification of air pollutants.

(c) What are the sources of important air pollutants?

UNIVERSITY OF KERALA

SYLLABUS FOR COMPLEMNTARY CHEMISTRY OF FOR ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	II
COURSE	2
COURSE NAME	INORGANIC CHEMISTRY
COURSE CODE	CH1231.4
CREDIT	2
L-T-P	2-0-2

TOTAL HOURS	36

CO No.	COURSE OUTCOME *Upon completion of this course, the students,:*	Cognitive Level
1	Understand the biological and environmental aspects of organic compounds	U
2	Comprehend the meaning of stability of nucleus	R
3	Summarise the applications of radioactivity	U
4	Predict the properties of transition metal complexes	A
5	Understand the applications of metal complexes	U
6	Learn to appreciate biological processes like photosynthesis, respiration etc	E
7	Discuss the biochemistry of trace elements	U,E

R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I :ORGANOMETALLICS **9Hrs**

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications

Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses

Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture

Environmental aspects of Organometallic compounds

MODULE II NUCLEAR CHEMISTRY **9Hrs**

Natural radioactivity, modes of decay, Geiger–Nuttal rule-

Artificial transmutation and artificial radioactivity-

Nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion-

Applications of radioactivity- ^{14}C dating, rock dating, neutron activation analysis and isotope as tracers

MODULE III - COORDINATION CHEMISTRY 9Hrs

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism

Valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes

Application of metal complexes in qualitative and quantitative analysis

MODULE IV – BIO INORGANIC COMPOUNDS 9Hrs

Metalloporphyrins – cytochromes –

Chlorophyll - photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of O_2 – CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

References

6. Co-ordination Chemistry – Bosolo and Johns
7. Chemistry of Organometallics – Rochoco.
8. Concise Inorganic Chemistry – J.D. Lee

9. Puri, Sharma and Kalia “Inorganic Chemistry”
10. Modern Inorganic Chemistry A.D. Madan

UNIVERSITY OF KERALA

II Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1231.4 Credit 2

INORGANIC CHEMISTRY

(2020 Admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Give the structure of Zeisel’s salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of $K_3[Co(NO_2)_4Cl_2]$
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?

10. Give an example of anaerobic respiration.

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is reformatsky reaction?

12. What is cisplatin? Give its significance.

13. How are organomercurials prepared?

14. Explain Geiger Nuttal Rule.

15. What are half life period and average life period?

16. Define mass defect and binding energy.

17. Write the postulates of Werner's Coordination Theory.

18. What are poly dentate ligands? Give an example.

19. Explain the colours of transition metal complexes.

20. Differentiate respiration and photosynthesis.

21. What are trace elements?

22. What is the role of chlorophil in photosynthesis?

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Write a note on organotin compounds.

24. Write a brief note on the applications of organometallic compounds in agriculture and horticulture.

25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?

26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss briefly the biochemistry of iron toxicity and nutrition.

31. Metal ions play a variety of roles in biological systems. Explain.

SECTION D

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

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)

(b) What are Frankland reagents? Give its significance. (5 marks)

(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)

(b) Give the principle of neutron activation analysis. (5 marks)

(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5 marks)

(c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

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SYLLABUS OF COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1331.4**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Classify carbohydrates, aminoacids, proteins, nucleic acids, lipids, polymers and drugs.	**U**
2	Summarize optical, geometrical and conformational isomerism Draw the structure of simple carbohydrates	U
3	Discuss the structure of proteins	U
4	Explain the synthesis of amino acids, peptide,drugs	U

5	Predict absolute configuration of stereo centers	A

R-Remember, U-Understand, A-Apply

MODULE I – STEREOCHEMISTRY **9 Hrs**

Optical isomerism – chirality, Enantiomers, racemisation- Optical isomerism of lactic and tartaric acid- Resolution and methods of resolution

Relative and absolute configuration, Enantiomeric excess, asymmetric synthesis

Geometrical isomerism, geometrical isomerism in maleic and fumaric acid, E and Z nomenclature-Aldoximes and ketoximes

Conformational isomerism-Rotation about carbon – carbon single bond, conformation of ethane, butane cyclohexane, axial and equatorial bonds

MODULE II – CARBOHYDRATES **9Hrs**

Classification. Configuration- glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose

Preparation and properties of glucose and fructose

Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected)

Mutarotation and epimerization

Properties and structure of sucrose. (structure elucidation not expected)

Structure of starch and cellulose (Elementary idea only)

MODULE III – AMINO ACID AND PROTEINS **9 Hrs**

Classification and properties of aminoacids

Synthesis of glycine, alanine and tryptophan

Polypeptides and proteins, peptide linkage, peptide synthesis

Primary,secondary, tertiary and quarternary structure of proteins

Test for proteins

Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory- Co-enzymes

MODULE IV– NUCLEIC ACIDS AND LIPIDS **9 Hrs**

RNA, DNA – their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids

Replication of DNA- Transcription and Translation - Genetic code

Lipids – Classification oils, fats and waxes, iodine value and saponification value, properties of oils and fats – phospholipids

MODULE V – POLYMERS **9 Hrs**

Classification with example – natural and synthetic polymers – condensation and addition polymerization- Elastic fibres, thermoplastics and thermosetting plastics

Terpenes – classification, isoprene rule, essential oils, elementary study of citral and geraniol (structure elucidation not required)

Rubber - structure – Vulcanisation of rubber – synthetic rubber – neoprene, butyl rubber, Buna S, Buna N

MODULE VI – DRUGS **9 hours**

Classification of drugs- analgesic, antipyretic, antibiotic, hypnotics, sulphadrugs, antacids, antimalarials

Mode of action of sulpha drugs

Synthesis of aspirin, sulphaguanidine, Paracetamol

Drugs of plant origin- anticancer compounds from plants

UNIVERSITY OF KERALA

III Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1331.4 Credit 3

ORGANIC CHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1) Give an example of a Sulpha drug.
2) Write the structure of aspirin.
3) Draw the most stable conformer of cyclohexane.
4) Write the epimer of D-Glucose.
5) What are polysaccharides?
6) What are zwitter ions?
7) Relationship between the base sequence in DNA and the amino acid sequence in protein is known as ……..
8) Write the structure of tryptophan.
9) Name the monomer of natural rubber.
10) Name the purine bases present in DNA.

SECTION B

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

11) What is atropisomerism?
12) How will you prepare sulfaguanidine?
13) What is asymmetric synthesis? Illustrate.
14) Explain racemisation.
15) What is inversion of cane sugar?
16) What are copolymers?
17) Explain saponification value.
18) What is zwitter ion?
19) Draw the structure of D-Arabinose, D-Ribose, L-Glyceraldehyde and L-Erythrose.
20) What are phospholipids?
21) Name the products of hydrolysis of nucleoproteins.
22) What do you understand by the term Buna-N?

SECTION C

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

23) Write a note on the mode of action of sulpha drugs.
24) Explain the E & Z notation of geometrical isomers with examples.
25) Explain mutarotation and epimerization.

26) Explain the following denaturation and colour reactions of protein.

27) Explain isoprene and special isoprene rule

28) What are lipids? Give examples. Enumerate their functions.

29) Describe the synthesis of Paracetamol.

30) What are enzymes? Give their general characteristics.

31) What is iodine value? Write its importance.

SECTION D

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

32) (a) What are drugs? How are they classified

(b)Explain enzyme catalysis using Michaelis – Menton theory

(c) Assign the R and S configuration of D- & L- Lactic acid. (6+4+5

33) (a) What is resolution? Explain any two methods.

(b) Explain the geometrical isomerism in maleic and fumaric acid.

(c) Discuss the ring structure of glucose. (5+5+5)

34) (a) Explain two methods of synthesizing peptides.

(b) Discuss primary and secondary structure of proteins.

(c) Comment on the structure of starch and cellulose. (5+5+5)

35) (a) Describe the classification of oils.

(b) Discuss the structure of DNA.

(c) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine (iii) CH_3OH and dry Conc.HCl.

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SYLLABUS OF COMPLEMENTARY CHEMISTRY FOR ZOOLOGY MAJORS

SEMESTER	**IV**
COURSE	**4**

COURSE NAME	**PHYSICAL CHEMISTRY**
COURSE CODE	**CH1431.4**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Classify reactions on the basis of order and molecularity	U
2	Discuss different concepts of acids and bases	R,U
3	Understand different techniques used for the study of colloids	U
4	Calculate rate and order of reactions	E,A
5	Review the principles underlying the working of sophisticated instruments	U

*R-Remember, U-Understand, A-Apply

MODULE I - CHEMICAL KINETICS **9 Hrs**

Rates of reactions, various factors influencing rates of reactions

Order and molecularity - Zero, first, second and third order reactions

Derivation of integrated rate equation, fractional life time, units of rate constants Influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenius parameters – Collision theory

Catalysis- Different types of catalysis- intermediate compound formation theory and adsorption theory

MODULE II–IONIC EQUILIBRIUM 9 Hrs

Arrhenius, Lowry- Bronsted concepts of Acids and Bases- Kw & pH

pH of strong acid and weak acid Ka & Kb,

Mechanism of Buffer action- Henderson equation –pH of Buffer

Hydrolysis of salt – degree of hydrolysis and hydrolytic constant

MODULE III- COLLOIDS 9 Hrs

Colloidal state- Types of colloids

Preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids

Ultra microscope, Electrical double layer and zeta potential

Coagulation of colloids, Hardy-Schulz rule

Micelles and critical micelle concentration, sedimentation

Application of colloids – Cottrell precipitator, purification of water and delta formation

MODULE IV - SPECTROSCOPY 9 Hrs

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation-

Concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects.

UV-Visible spectra of enes - Calculation of λmax

Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH

Principle of MRI

MODULE V- INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS 9 Hrs

Principle – instrumentation and applications of Atomic absorption spectroscopy- flame emission spectroscopy

Thermal methods - thermogravimetry (TG) - Differential thermal analysis (DTA)

Gas Chromatography- HPLC

Introduction to zone electrophoresis and capillary electrophoresis

MODULE VI SOLUTIONS 9 Hrs

Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures

Raoult's law, vapour pressure- composition and temperature-composition curves, fractional distillation, deviation from Raoult's law

Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST, Theory of steam distillation

Text Books /References

1. Organic Chemistry of Natural Products, Chatwal,Gurdeep.R, Himalaya Publications
2. Principles of physical chemistry, Puri Shrama Pathania, Vishal
3. Chemistry of natural products, P.S. Kalsi, New Age International Private Ltd
4. Elementary organic spectroscopy, Y.R Sharma, S chand & Company
5. Principles of Physical Chemistry, B.R.Puri, R.L.Sharma & Pathania, Vishal Publishing
6. Essentials of Physical Chemistry, B.S. Bahl., G.D. Tuli & Arun Bahl , S.Chand & Co., New Delhi.
7. Simplified Course in Physical Chemistry, R.L. Madan, G.D. Tuli , S.Chand & Co.
8. Chromatography, B.K .Sharma, GOEL Publishing house, Meerut

UNIVERSITY OF KERALA

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Zoology Majors

Course Code CH1431.4 Credit 3
PHYSICAL CHEMISTRY
(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define P^H.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift
7. Explain chromophore with an example.
8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Write a short note on zone electrophoresis

SECTION B

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

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constant of a chemical reaction on the absolute temperature and explain the terms involved.
13. Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?
15. What is critical micelle concentration? Discuss the structure of micelles in polar and nonpolar media
16. Tetra MethyL Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Explain the working of Hollow Cathod Lamp
19. What is the difference between GC and HPLC?
20. Explain the terms Degree of hydrolysis and hydrolysis constant.
21. What are the conditions at which the solutions deviate from ideal behaviour?
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

SECTION C

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

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31 \times 10^{-3}\ s^{-1}$. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = 1.85×10^{-5}.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

29. Which of the following will show spin- spin coupling in their NMR spectra? If coupling is observed, give the spin multiplicity : (a) $ClCH_2CH_2Cl$ (b) CH_3COCH_3 (c) CH_3CHO (d) $ClCH_2CH_2I$

30. Briefly explain TGA taking suitable example

31. Explain the principle of Fractional Distillation

SECTION – D

(*Answer **any 2** question. Each question carries 15 marks*)

32. (a)Differentiate between Molecularity and order of a reaction with examples

(b) Discuss the Kinetic, optical and electrical properties of colloids

(c) Explain the protective action of colloids

33. (a) Discuss the principle and applications of AAS

(b) Distinguish between AAS and FES

(c) Explain the applications of TGA and DTA

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples.

(b) Define critical solution temperature. Explain systems having upper and lower CST using examples

(c) Explain the applications of UV spectroscopy

35. (a) Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.

(b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR spectrum of ethanol molecule.

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF ZOOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE TITLE	**COURSE V : LAB COURSE FOR ZOOLOGY**
COURSE CODE	**CH 1432.4**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR ZOOLOGY MAJORS)

Course Code CH1432 .3 Credit 2

I. QUALITATIVE ANALYSIS

A. Reactions of organic compound
B. (aromatic – aliphatic,
C. saturated – unsaturated,
D. detection of elements
E. Detection of functional group

glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters.

II. Systematic analysis with a view to identify the Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

III. ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

IV. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

V. GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

VI.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in semesters I-IV

COMPLEMENTARY CHEMISTRY FOR HOMESCIENCE MAJORS

DISRIBUTION OF HOURS AND CREDITS

Semester	Hours/Week	No. of	Course Code	Instructional

	Thoery(L)	Lab(P)	Credits		Hours
I	2		2	CH1131.5	2x18=36
		2	-		2x18=36
II	2		2	CH1231.5	2x18=36
		2	-		2x18=36
III	3		3	CH1331.5	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.5	3x18=54
		2	4	CH1432.1	2x18=36

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**INORGANIC AND ANALYTICAL CHEMISTRY**
COURSE CODE	**CH1131 .5**
Credit	**2**
TOTAL HOURS	**36**
L-T-P	**2-0-2**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the Bohr atom model and represent electronic configuration of elements	U	
2	Discuss the theory of volumetric analysis	U	

3	Explain radioactivity and its applications	A	
4.	Applies the importance of radioactivity in terms of energy and environment conservation.	A	
5.	Classify organometallics	U	
6.	Identify the importance and impact of organometallics.	U	

Re-Remember, Un-understand, Ap-apply

MODULE I –ATOMIC STRUCTURE (9 Hrs)

Atomic spectra of hydrogen,-different series, Rydberg equation. Bohr theory-postulates –statement of Bohr energy equation –derivation of spectral frequency from Bohr equation-Schrodinger wave equation(mention only), concepts of orbitals, the four quantum numbers and their significance- Orbital wise electron configuration, energy sequence rule, Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

MODULE II- ANALYTICAL PRINCIPLES (9 Hrs)

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems, theory of acid base titrations, permanganometric and dichrometric titrations, theory of acid base and redox indicators.(Numerical problems are to be worked out) .

MODULE III- RADIOACTIVITY AND NUCLEAR CHEMISTRY (9Hrs)

Radioactive decay series, Radioactive equilibrium, Average life, Half life detection of radio activity-Geiger Muller Counter, Wilson cloud chamber, Units of radioactivity-Curie and Rutherford, Units of radiations. Nuclear Chemistry-stability of nucleus, n/p ratio, artificial transmutation and radioactivity, mass defect, binding energy, Applications of radio activity- in medicine, agriculture and archeology. Biological effects of radiation, pathological and genetic damage.

MODULE IV- ORGANOMETALLICS AND BIOMOLECULES (9 Hrs)

Organometallic compounds –Definition and classification, Biological , medicinal and environmental aspects organo mercury, boron, silicon and arsenic compounds. Biomolecules – Metallo porphyrins, Haemoglobin and Myoglobin. Structure and Physiological functions.

References

1. Concise Inorganic Chemistry J. D. Lee

2. Inorganic Chemistry — Puri and Sharma

3. Chemistry of Organometallics — Rochow

4. Organic Chemistry Vol 2 — I.L. Finar

5. Chemistry of natural products Vol. 1 — Gurdeep Chatwal

6 The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla

7. Modern Inorganic Chemistry — R D Madan

II Semester Complementary Chemistry Model Question paper

(for Homescience Majors)

Course Code-CH1131 .5 Credit 2

INORGANIC AND ANALYTICAL CHEMISTRY

Time : Three Hours **Total marks : 80**

Section – A

Answer all questions. Each question carries 1 mark

1. Give the relationship between wavelength, frequency and velocity of electromagnetic radiation?
2. What is the Rydberg equation for calculating the wave number of radiation?
3. Give Schrodinger equation which describes the behaviour of electron in an atom?
4. Indicator used for the titration between strong base and weak acid?
5. Give two examples of primary standard?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Give two examples of Organomercuric comounds in medicine ?
10. What are organometallic comounds? (1×10=10 marks)

Section – B

Answer any eight. Each question carries 2 marks

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. 50 ml of 0.25N NaOH required 40 ml aqueous HCl solution, calculate the normality of HCl solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes? (8 x 2 = 16 marks)

Section – C

Answer any six. Each question carries 4 marks

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?
25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine? (6 x 2 = 24 marks)

Section – D

Answer any two. Each question carries 15 marks

32. a) Derive the Bohr frequency equation?(5marks)
    c) Discuss the atomic spectra of hydrogen atom.(5 marks)

    b) Explain quantum numbers. (5 marks)

33. a)Write notes on Acid base indicators? (5 marks)
    b)Explain the Permanganometric titration? (5mark)

    c) Calculate the weight required to prepare the following solutions (i) N/5 aqueous solution of sodium carbonate in 250ml (ii) M/5 aqueous solution of sodium carbonate

in 100 ml.

34. a)What are the applications of radioactivity in medicine and agriculture? (6marks)
b) Write notes on radioactive decay series? (5mark)

c) A living plant acquires definite fraction of ^{14}C nuclei in its carbon content. If a freshly cut piece of wood gives 16.1 counts per minute per gram and an old wooden bowl gives 9.6 counts per minute per gram of carbon, calculate the age of the wooden bowl. The half life of ^{14}C is 5770 years.

35. a) Write in detail the classification of organometallic compounds with examples? (5 marks)

b) Explain the biological aspects of myoglobin? (5marks)

c) Discuss the structure of Haemoglobin. (5 marks) (2 x 15 = 30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**ORGANIC CHEMISTRY**
COURSE CODE	**CH1231 .5**
CREDIT	**2**
TOTAL HOURS	**36**
L-T-P	**2-0-2**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level
1	Identify and represent the structure of simple carbohydrates	U
2	Assign role of vitamins and hormones for different biological activities	U

3	Identify the deficiency diseases caused by vitamins and hormones	A
4.	Classify carbohydrates, vitamins, amino acids and enzymes.	A
5.	Discuss the structure of proteins.	U

Re-Remember, Un-understand, Ap-apply.

MODULE I: CARBOHYDRATES (9hrs)

Classification, configuration of glyceraldehydes, erythrose, threose, ribose,2- deoxy ribose, arabinose, glucose, fructose and mannose. Reactions of glucose and fructose. Pyranoside structures of glucose and fructose Furanoside structure of fructose (structure elucidation not expected), muta rotation, epimerization, conversion of glucose into fructose and vice versa.

MODULE II VITAMINS (9hrs)

Classification, source, physiological function and deficiency diseases caused by Vitamin A1(retinol), A2(axerophthol), Vitamin B-B1 (thiamine), B2(riboflavin and folic acid), B5(niacin), B6(Pyridoxine), B12 (Cyano cobalamine) Vitamin C (ascorbic acid),–Vitamin,D2 (ergocalciferol), Vitamin E (Tochopherols), Vitamin H(biotin) and Vitamin K.

MODULE III :AMINOACIDS AND PROTEINS (9hrs)

Classification. synthesis of glycine, alanine, phenyl alanine and aspartic acid, zwitter ion, isoelectric point,, reactions of aminoacids, peptide linkage, peptide synthesis, polypeptides, primary, secondary, tertiary and quarternary structure of proteins, classification, biological importance and tests for proteins.

MODULE IV: ENZYMES AND HORMONES (9hrs)

Enzymes- Characteristics, classification, factors influencing enzyme action, mechanism of enzyme action, Michaelis –Menton theory, enzyme inhibitors.

Hormones- Introduction, functions and abnormalities due to oxytocin, thyroxin,

glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin

Text Books/References

1. Fundamentals of Biochemistry A.C. Deb
2. Biochemistry Rastogi

3. Chemistry of Organometallics Rochow
4. Organic Chemistry Vol 2 I.L. Finar
5. Chemistry of natural products Vol. 1 Gurdeep Chatwal
6. The Text Book of Organic Chemistry P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry R D Madan

Model Question paper
II Semester Complementary Chemistry Model Question Paper
(For Home Science Majors)
Course Code CH1231 .5 Credit 2
2020 Admission onwards
ORGANIC CHEMISTRY

Time : Three Hours **Total marks : 80**

Section – A

Answer all. Each question carries 1 mark.

1. Write the name of a neutral aminoacid?
2. Give the name of an essential aminoacid?
3. What is peptide linkage?
4. Give the name of a monosaccharide?
5. Write one reaction of glucose?
6. What is a carbohydrates?
7. Give the other name of oxytocin?
8. Give the name of two enzymes?
9. Give two functions of enzymes?
10. Which vitamin is called anti haemorrhagic vitamin? (10 x 1 = 10 marks)

Section – B

Answer any eight. Each question carries 2 marks

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?

18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation? (8 x 2 = 16 marks)

Section C

Answer any six. Each question carries 4 marks

23. What is the reaction of amino acid with nitrous acid?
24. Explain the isoelectric point of an aminoacid?
25. Give the method of synthesis of glycine?
26. What are the factors affecting enzyme action?
27. Give the functions and deficiency diseases of vitaminC ?
28. What is Michaeli's Menton theory of enzyme action?
29. Write a note on Furanoside structure of fructose?
30. How will you convert glucose into fructose?
31. Write configuration of glyceraldehydes and erythrose? (6 x 4 = 24 marks)

Section – D

Answer any two. Each question carries 15 marks

32. a) Explain the primary, secondary and tertiary structure of protein. (10 marks)
    b) Describe any one method of synthesizing aspartic acid (5 marks)

33. a) What are vitamins? How are they classified? (3marks)
    b) Discuss the physiological functions of vitamin A1, B2, B12, C and D (8 marks)

    c) Listout the different sources of vitamins (4 marks)

34. a) Discuss the functions of the following hormones (i) thyroxin, (ii) glutathione (iii)

    progesterone (6 marks)

    b) List out and explain the abnormalities due the deficiency of the following hormones

    (i) estrogens (ii) cortisone (iii) adrenalin. (6 marks)

    c) Discuss on enzyme inhibitors. (3 marks)

35. Discuss:

    (a) classification of carbohydrates. (3 marks)

    (b) pyranose structure of glucose. (5 marks)

    (c) Reaction of glucose with (i) Bromine water (ii) Tollen's reagent (iii) phenyl

    hydrazine. (6 marks)

(2 x 15 = 30marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE NAME	**ORGANIC CHEMISTRY -II**
COURSE CODE	**CH1231 .5**
CREDIT	**3**
TOTAL HOURS	**54**
L-T-P	**3-0-2**

Semester-III

Complementary Course No. - 3

Course Code-CH1331 .5 – Organic Chemistry- II
Total: 54 hours

Credit-3 **L-T-P 3-0-2**

Course Outcomes

CO No.	**Expected Course Outcomes** Upon completion of this course, the students	Cognitive Level	PSO No.
1	**Understand the chemistry of simple heterocyclics**	**Un**	
2	**Give an insight about the role of chemistry in the world of dyes**	**Un**	
3	**Develop an understanding about the phytochemicals like alkaloids and terpenes**	**Ap**	
4.	**Appreciate the achievements of polymer molecule in the field of medicine & food packaging**	**Ap**	

5.	**Classify drugs and polymers**	**Un**	

Re-Remember, Un-understand, Ap-apply.

MODULE 1:HETEROCYCLICS (9hrs)

Introduction, Classification and nomenclature. Preparation, physical properties, acidic and basic character, aromatic character, addition , substitution, oxidation and resonance structures of pyrrole, furan, thiophene and pyridine. Purine and pyrimidine bases.

Module 2: Terpenes (9hrs)

Introduction, isolation, occurrence, isoprene rule, classification.

Physical and chemical properties and uses of citral, geraniol, menthol and camphor.

An elementary idea of the structure of natural rubber, synthetic rubber, Buna-N, Buna-S, Neoprene and Thiokol.

Module 3: Alkaloids (9hrs)

Occurrence, classification, general methods of isolation. General methods of determining structure: Functional nature of oxygen containing groups – identification of hydroxyl group, carboxyl group, oxo group, ester group, methoxyl group, methylenedioxyl group. Functional nature of nitrogen containing groups – identification of primary, secondary and tertiary amino groups, Hoffmann exhaustive methylation . Structure and physiological actions of coniine, nicotine, quinine, morphine and codeine (structure elucidation is not expected).

Module 4: Medicinal Chemistry (9hrs)

Chemo therapy- Drugs-Classification based on application. Elementary study of analgesics,

antipyretics, antibiotics, antimalarials. sulphadrugs, mode of action of sulphadrugs.

Synthesis of aspirin and paracetamol

Module 5: Polymers (9hrs)

Natural and synthetic polymers, preparation and uses of vinyl polymers-PE, PVC, PVA, PS, PVF, PMMA, PTFE, Synthetic fibres-Nylon, Nylon 66,Terylene, Poly ethyl teraphthalate, polymers in medicine, surgery and food package.

Module 6: Colour and constitution, Dyes (9hrs)

Colours, complimentary colours, Theories of colour and constitution - chromophore-auxochrome theory, modern theory of colours. Classification of dyes on the basis of

structure and application. Preparation and uses of para red and methyl orange, phenolphthalein and fluorescein , Alizarin, malachite green.

REFERENCES:

1.Essentials of Physical Chemistry	B S Bahl GD Thuli Arun Bahl
2. Analytical chemistry	S M Khopkar
3. Chemistry of natural products Vol. 1	Gurdeep Chatwal
4. Text Book of Organic Chemistry	P.L Soni, H.M. Chowla
5. Organic ChemistryVol 1 & 2	I.L. Finar
6. Text Book of Organic Chemistry	Arun Bahl & B S Bahl
7. Polymer Chemistry	B.K Sharma
8. Inorganic Polymer Chemistry	G S Misra
9. Inorganic Chemistry	Puri and Sharma

III Semester Complementary Chemistry Model Question paper

(for Homescience majors)

Course - III , Course Code-CH1331 .5

ORGANIC CHEMISTRY - II

Time : Three Hours **Total marks : 80**

Section – A

Answer all questions. Each question carries1 mark

1. Give two examples for nitrogen containg heterocyclics.

2. Draw the structure of furan and thiophene.
3. An alkaloid present in hemlock herb.
6. Give an example for a drug used as an antipyretics.
7. What are antimalarials?
8. What are complementary colours?
9. Explain chromophore with an example.
10. Draw the structure of citral.
11. How many isoprene units are in sesquiterpenes ?
12. Write any two uses of PVC. (1×10=10 marks)

Section – B

Answer any eight. Each question carries 2 marks

13. Explain any one method of preparation of furan.
14. Write the names of purine bases present in nucleic acids.
15. What are drugs?
16. Name two antibiotics.
17. How will you prepare phenolphthalein?
18. What is mordant dye? Give an example
19. What is Buna rubber?
20. Write the reaction of citral with silver oxide.
21. Draw the structure of morphine.
22. How is the functional nature of OH analysed in alkaloids ?
23. What is Bakelite?
24. Give the structure of Nylon 66. (2×8 =16 marks)

Section – C

Answer any six. Each question carries 4 marks

25. Compare the basic character of pyridine and pyrrole.
26. Write a note on the classification of heterocyclics.
27. What are analgesics? Give examples. Discuss any one method to synthesis a commonly used analgesics.

28. Explain the isomerism shown by citral and geraniol.
29. What is Hoffmann exhaustive methylation?
30. Write the structure and physiological actions of nicotine.
31. Write the synthesis and uses of fluorescein.
32. How is polystyrene synthesized?
33. Write a note on polymers in medicine and surgery. (4×6=24 marks)

Section – D

Answer any two. Each question carries 15 marks

34.a) Write a short note on the aromatic character of five membered heterocyclics. (5marks)

b) What happens when thiophene is treated with (i) H_2/Pd (ii) Maleic anhydride.

Explain using chemical equation.(5 marks)

c) How pyridine is synthesized? Discuss the nuclephilic substitution reactions of

pyridine. (5 marks)

35. a) What are terpenes? Discuss isoprene and special isoprene rule. (5 marks)

b) Describe (i) the general method of isolation of terpenes (ii) classification of terpenes

(5mark)

c) Comment on the classification and isolation of alkaloids (5 marks)

36. a)What are drugs? How are they classified (5marks)

b) What are sulphadrugs? Discuss its mode of action. (5mark)

c) What is aspirin? How is it synthesized? Write its uses.(5 marks)

35. a) Discuss the classification of dyes on the basis of application. (6 marks)

b) Explain the Witt's theory of colour and constitution (6 marks)

c) Write the structure of any (i) nitro dye (ii) azo dye (iii) anthraquinone dye (3 marks)

(2 x 15 = 30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMNTARY COURSE FRO HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	IV
COURSE	**4**
COURSE NAME	**PHYSICAL AND SUSTAINABLE CHEMISTRY**
COURSE CODE	CH1431.5
CREDIT	3
TOTAL HOURS	54
L-T-P	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level
1	Identify the role of colloids & adsorption phenomena in everyday life	A
2	Exposed to the knowledge of Chromatographic methods useful in the analysis.	U
3	Get an overview about the chemicals used as insecticide and pestiside in agriculture field.	U
4.	Get insight to the emerging areas of chemistry - Green and Nano chemistry	U
	Become cautious of the environmental threats and take steps for sustainable development	A
5.	Impart an idea about the chemical pollutants & their detrimental effects.	U

Re-Remember, Un-understand, Ap-apply.

MODULE 1: COLLOIDS (9hrs)

Introduction, dispersed phase, dispersion medium, classification, multi molecular, macromolecular and associated colloids. Preparation - condensation and dispersion methods,

purification -dialysis and ultra filtration, properties of colloidal solution- optical, kinetic and electrical properties, coagulation, Hardy-Schultz rule, protective colloid, applications of colloidal systems, emulsions, emulsifiers and cleansing action of soap.

MODULE 2: ADSORPTION AND CHROMATOGRAPHY (9hrs)

Adsorption-Adsorbent, adsorbate, desorption, types of adsorption - physical and chemical adsorption. Applications of adsorption. Chromatography- Column, TLC, paper and gas chromatography. Applications of chromatography in the separation of proteins, amino acids and dyes.

MODULE 3: GREEN & NANO CHEMISTRY (9hrs)

Green Chemistry: Chemical Pollution and its after effects, conventional waste disposal techniques & its Limitations. History of disasters like Chernobyl Disaster, Bhopal gas tragedy. Introduction to Green chemistry, twelve Principles of green chemistry.

Nano Chemistry: Introduction to nanochemistry, Nanosystems in Nature, Preparation methods for nanomaterials – top-down & bottom up approach (mention only)- sol gel synthesis, coprecipitation, colloidal precipitation, chemical vapour deposition. General introduction to nanomaterials – Fullerenes, Carbon nanotubes. Applications of nanomaterials in medical field.

MODULE-4:**INSECTICIDES AND PESTICIDES (**9hrs)

Insecticides - classification and preparation of compounds like DDT, DDE and BHC. Methoxy chlor, malathion, parathion and carbamates(mention only).

An elementary study of antiseptics, disinfectants, pesticides, rodenticides, herbicides and fungicides.

MODULE-5:ENVIRONMENTAL CHEMISTRY –I (9hrs)

Air and soil pollution-Introduction, different types of air and soil pollution, air pollutants SO_2, SO_3, NO,.NO_2 and smog. Acid rains, CO_2, CO, Green house effect, O_3, importance of ozone layer, causes and effects of ozone layer depletion. Photochemical oxidants, PAN, hydrocarbons, particulates, dust, smog, asbestos, lead, mercury, cadmium. Control of air pollution

MODULE-6:ENVIRONMENTAL CHEMISTRY – II (9hrs)

Water pollution-Factors affecting the purity of water, sewage water, Industrial waste, agricultural pollution such pesticides, fertilizers, detergents; treatment of industrial waste, water using activated charcoal, synthetic resins, reverse osmosis and electro dialysis.

References

1. An Introduction to Medicinal Chemistry	Graham L Patrick
2. Text Book of Organic Chemistry	P.L Soni, H.M. Chowla
3. Organic Chemistry Vol 1 & 2	I.L. Finar
4. Text Book of Organic Chemistry	Arun Bahl & B S Bahl
5. Environmental Chemistry	K. Banerji
6. Environmental Chemistry - An introduction	A. K. De
7. Air Pollution	B. K. Sharma
8. Environmental Chemistry: A global perspective	G.W. vanLoon & S. J. Duffy
9. Green Chemistry Environment Friendly Alternatives	Rashmi Sanghi and M.M Srivasthava
10.NANO: The Essentials	T. Pradeep

IV Semester Complementary Chemistry Model question paper

(for Home Science Majors)

Course Code CH 1431.5 Credit 3

PHYSICAL AND SUSTAINABLE CHEMISTRY

Time: 3hr **Total mark: 80**

Section A

Answer all questions. Each question carries1 mark

1. What is meant by Brownian movement?
2. What are gels?
3. Enthalpy of adsorption is negative. True or false.
4. Name an adsorbent in paper chromatography.
5. Who is the father of Green Chemistry?
6. What is an acid rain?
7. What is a smog ?
8. What is meant by top down approach in nano synthesis?
9. What is DDT & DDE?
10. What is PAN? (1 X 10 = 10 maks)

Section B

Answer any 8 questions. Each question carries 2 marks

11. What is meant by atom economy?
12. What is sol gel synthesis?
13. What is Fullerenes?
14. Write a note on electrical double layer and zeta potential.
15. Distinguish between coagulation and peptization.
16. Write a note on Gibb's adsorption isotherm.
17. What is an aerosol? Give an example?
18. What are herbicides and fungicides?
19. What is reverse osmosis?
20. What are the uses of methoxychlor?
21. What is meant by green house effect. Name two green house gases?
22. Write about the origin of Green Chemistry. (2 x 8 = 16 marks)

Section C

Answer any 6 questions. Each question carries4 marks.

23. What are micelles? Define critical micelle concentration.
24. What is gold no? Explain protective colloid.
25. What do you understand by physical and chemical adsorption?
26. Write important applications of adsorption.
27. Comment on Bhopal tragedy
28. Discuss on nanosystems in nature.
29. Write notes on herbicides and fungicides.
30. What are the causes and effects of ozone depletion?
31. What are the limitations of conventional waste disposal methods? (6 x 4 = 24 marks)

Section D

Answer any 2 questions. Each question carries15 mark

32. (a) Briefly explain the any six principles of green chemistry.(6 marks)
(b) Discuss the application of nanomaterials in medical field.(4 marks)

(c) Explain sol-gel method of synthesizing nano materials. (5 marks)

33. a) Explain adsorption chromatography.(5 marks)
b) Write a note on partition chromatography. (5 marks)

c) Discuss the principle and procedure of TLC.(5 marks)

34. a) Explain the cleansing action of soap.
b) Explain the Hardy-Schultz rule.

c) Discuss on (i) dialysis and (ii) ultrafiltration.

35. a) Discuss on the source of air pollution.(5 marks)
b) Describe the any two methods of water treatment. (5 marks)

c) How following compounds are prepared? (i) DDT (ii) BHC (5 marks)

(2 x 15 = 30 marks)

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF HOMESCIENCE MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE TITLE	**COURSE V : LAB COURSE FOR HOMESCIENCE**
COURSE CODE	**CH 1432.5**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry,	A

	permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE FOR COMPLEMENTARY CHEMISTRY

(FOR HOMESCIENCE MAJORS)

Course Code CH1432 .5 Credit 2

III. QUALITATIVE ANALYSIS

F. Reactions of organic compound
G. (aromatic – aliphatic,
H. saturated – unsaturated,
I. detection of elements
J. Detection of functional group

glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters.

IV. S

ystematic analysis with a view to identify the Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

III. ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

IV. VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

V. GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

VI.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in semesters I-IV

SYLLABUS OF COMPLEMENTARY CHEMISTRYY COURSES

(FOR BIOCHEMISTRY MAJORS)

DISTRIBUTUIN OF HOURS

One Semester – 18Weeks

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Thoery(L)	Lab(P)			
I	2		2	CH1131.6	2x18=36
		2	-		2x18=36
II	2		2	CH1231.6	2x18=36
		2	-		2x18=36
III	3		3	CH1331.6	3x18=54
		2	-		2x18=36
IV	3		3	CH1431.6	3x18=54
		2	4	CH1432.6	2x18=36

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**THEORETICAL CHEMISTRY**
COURSE CODE	**CH1131.6**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students ,*	**Cognitive Level**
1	Understand the relevance of periodic classification of elements	U
2	Understand the significance of quantum numbers	U
3	List the various chemical bonds	R
4	Apply the VSEPR theory to explain the geometry of molecules	A
5	Appreciate the laws of thermodynamics	U

6	Understand spontaneity	U
7	Compare the stabilities of various nuclei	E
8	Appreciate the applications of radioactivity	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I–PERIODIC TABLE AND CLASSIFICATION OF ELEMENTS 9 hours

Quantum numbers and their significance- Orbit and orbitals, shape of s, p and d orbitals, Orbital wise electron configuration, energy sequence rule, Aufbau principle, Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Modern periodic law. Periodicity of elements and basis of classification of elements into s,p,d,and f block. Variation of periodic properties – atomic and ionic size, metallic and non metallic character, diagonal relationship.

MODULE II- CHEMICAL BONDING **9hours**

Energetics of bond formation, Ionic bonding, Born-Haber cycle-
Covalent bonding, hybridization and structure of molecules-sp, sp^2 ,sp^3 ,dsp^2 ,d^2sp^3 ,sp^3d^2 hybridisation with examples-
VSEPR Theory with regular and irregular geometry, explanation of bond angle in water and ammonia-
Polarity of covalent bond, its relation with electronegativity, factors influencing polarity, dipole moment, its relation to geometry-
Hydrogen bond, intra and intermolecular hydrogen bond, its consequence on BP, volatility and solubility-
Partial covalent character of ionic bond, Fajan's rule

MODULE III: THERMODYNAMICS **9hours**

Basic concepts – System – surroundings – open, closed and isolated systems
Isothermal– isochoric and isobaric process
Work – heat – energy – internal energy
Heat capacity at constant volume (Cv) and at constant pressure (Cp) – relation between Cp and Cv – First law– The second law – Enthalpy-Entropy-and Free energy
Criteria for reversible and irreversible process
Gibbs –Helmholtz equation
Concepts of spontaneous and non spontaneous processes

MODULE IV: NUCLEAR CHEMISTRY ***9 hours***

Nuclear Chemistry- stability of nucleus, n/p ratio, Radioactivity, Radioactive decay series, Radioactive equilibrium, Average life, Half life
Detection of radio activity-Geiger Muller Counter, Wilson cloud chamber
Units of radioactivity-Curie and Rutherford
Artificial transmutation and radioactivity, Units of radiations
Applications of radio activity- in archeology, medicine and agriculture.
Biological effects of radiation, pathological and genetic damage
Mass defect, binding energy, neutron activation analysis

REFERENCES

1. Concise Inorganic Chemistry -J. D. Lee
2. Inorganic Chemistry- Puri and Sharma
3. Chemistry of Organometallics- Rochow
4. Organic Chemistry Vol 2 -I.L. Finar
5. Chemistry of natural products Vol. 1-Gurdeep Chatwal
6. The Text Book of Organic Chemistry - P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry- R D Madan

First semester B.Sc Degree Examination Model question paper

Complementary course for Biochemistry Majors

CH1131.6: THEORETICALCHEMISTRY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. Define orbital.
2. What is the geometry of SF_6?
3. Which is bigger in size, Na or Na+? Why?
4. Which is steam volatile- o-nitro phenol or p-nitro phenol?
5. $BeCl_2$ is linear. Is it polar or non polar?
6. What is meant by transmutation?
7. Name two units of radioactivity?
8. What is meant by half life period?
9. Define system.
10. What is an isochoric process? (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. How atomic size varies in a period?
14. Write the electronic configuration of Cu and Cr.
15. State Fajan's rule.
16. What is bindingenergy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. Mathematical expression for First law of thermodynamics.
20. Differentiate open and isolated systems.
21. Define entropy. What is its unit.
22. Give an example for a polar covalent bond. Explain. (8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. How the metallic and non-metallic character of elements vary down a group and along a period.
24. What is hydrogen bonding? Explain different types of hydrogen bonding with examples.
25. Discuss Born-Haber cycle.
26. Derive the relationship between Cp and Cv.
27. Write the stability of nucleus with respect to n/p ratio?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. State and explain first and second laws of thermodynamics.
31. Discuss (i) Pauli's principle (ii) Aufbau order (6 x 4 = 24 marks)

SECTION D

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

32. a) State and explain modern periodic law. (3 marks)
    b) Comment on the classification of elements into different blocks in the periodic table.(8 marks)
    c) Explain quantum numbers.(4 marks)
33. a) What is hybridisation? Discuss the shape of methane, ethylene and acetylene on the basis of hybridisation (10marks)
    b) Explain the structure of H_2O and NH_3 on the basis of VSEPR theory
34. a)What are the applications of radioactivity in medicine and agriculture? (6mark) b).Discuss on carbon dating? (5mark)
    c) ^{14}C in a living sample of wood is 15.4 counts per minute and that of an unknown sample is only 4.8 counts per minute. Find the age of the unknown sample.(Half life of ^{14}C = 5730 years)
35. a) Define the terms (i) internal energy (ii) enthalpy (iii) free energy (3 marks)
    b)What are spontaneous and non spontaneous processes. Give examples (4 marks)
    c) What is Gibbs-Helmholtz equation? How is it applied for predicting spontaneity of reactions? (8 marks) (2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**II**
COURSE	**2**
COURSE NAME	**PHYSICAL AND ANALYTICAL CHEMISTRY - I**
COURSE CODE	**CH1231.6**
CREDIT	**2**
L-T-P	**2-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students* **,**	**Cognitive Level**
1	Illustrate Le Chatelier's Principle	E
2	Compare weak and strong acids	E
3	Appreciate the effect of pH in qualitative analysis	A
4	Calculate the strength of various solutions	U,A
5	Recognize various types of titrations	A
6	Apply Hess's law	A
7	Understand the strength of bonds	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: CHEMICAL EQUILIBRIUM ***9 hours***

Reversible reactions –Equilibrium constants, Kp, Kc, and Kx and their inter relationships

Free energy change and chemical equilibrium (thermodynamic derivation not

required)

Le Chatelier's principle and the influence of pressure, temperature and concentration on the following reversible reactions at equilibrium

1. Formation of NH_3 from H_2 and N_2
2. Formation of SO_3 from SO_2 and O_2
3. Dissociation of PCl_5 to PCl_3 and Cl_2

MODULE II - IONIC EQUILIBRIUM ***9 hours***

Arrhenius, Lowry- Bronsted and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant

Solubility product, Common ion effect, application in separation of ions, Example : NH_4Cl/NH_4OH in cation analysis, salting out process

MODULE III - ANALYTICAL PRINCIPLES ***9 hours***

Principles of volumetric analysis, primary standards, Standard solutions, normality and molarity, numerical problems on calculation of strength of solutions in normality, molarity

Theory of acid base titrations, Titration curve of strong acid -strong base, weak acid - strong base and strong acid -weak base titrations and theory of acid base indicator

Redox titrations- permanganometric and dichrometric titrations, and redox indicators

MODULE IV - THERMOCHEMISTRY ***9 hours***

Enthalpies of formation, combustion, neutralization, solution and hydration

Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature-Kirchoff's equation

Hess's law and application

Bond dissociation energies and bond energies of different types of bonds

Calculation of Bond energy, bond dissociation energy and enthalpies of reaction

REFERENCES

1. Concise Inorganic Chemistry J. D. Lee
2. Inorganic Chemistry Puri and Sharma
3. Chemistry of Organometallics Rochow
4. Organic Chemistry Vol 2 I.L. Finar
5. Chemistry of natural products Vol. 1 Gurdeep Chatwal
6. The Text Book of Organic Chemistry P.L Soni, H.M. Chowla
7. Modern Inorganic Chemistry R D Madan

Second Semester B.Sc Degree Examination Model question paper

Complementary course for Biochemistry Majors

CH1231.6: PHYSICAL AND ANALYTICAL CHEMISTRY - I

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What is reversible process?
2. Define pH.
3. What are Arrhenius acids?
4. Name an indicator used for strong acid weak base titration?
5. Give two examples primary standards?
6. What is astandard solution?
7. Define enthalpy of combustion?
8. What is Cp?
9. What is the ionic product of water?
10. Define equilibrium constant. (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. State Le-Chatlier principle.
12. Give the expression for the Ka of acetic acid.
13. Calculate the pH of 0.01M HCl.
14. What is degree of hydrolysis?
15. Define Lewis acid and base.
16. Differentiate between molarity and normality.
17. Calculate the weight of Na2CO3 required to prepare 250ml N/10 solution.
18. What is bond dissociation energy?
19. Why HCl is not used in permanganometry?
20. Define enthalpy of hydration?
21. What are the characteristics of chemical equilibrium?
22. Give a direct application of first law of thermodynamics in thermochemistry.

(8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Calculate the equilibrium constant for a reaction at 298K. (ΔG^0 = 20 Kcal)
24. Predict the effect of pressure on the dissociation of PCl_5.

25. Explain the theory of acid - base titration.
26. Comment on the Lowry-Bronsted concept.
27. Write a note on dichrometric titrations.
28. Calculate the pH of a buffer solution containing 0.2 moles of NH_4Cl and 0.1 mole of NH_4OH per liter. K_b for NH_4OH is 1.85×10^{-5}
29. Derive relation between Kh, Kw and Ka.
30. The enthalpy of formation of methane at constant pressure and at 300K is -75.83KJ. What will be the enthalpy of formation at constant volume.
31. From the following data at 298K, Calculate the bond energy of O-H bond.

    $H_2(g) \rightarrow 2\ H(g)$; $\Delta H1 = 436.08KJ$

    $O_2(g) \rightarrow 2\ O(g)$; $\Delta H2 = 495.17KJ$

    $H_2(g) + \frac{1}{2}\ O_2(g) \rightarrow H_2O\ (g)$; $\Delta H3 = -241.84KJ$ (6 x 4 = 24 marks)

SECTION D

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

32. a) Derive relation between Kp and Kc (5 marks)
    b) Apply Le-Chatlier principle for the following equilibria
        i) $N_2 + 3\ H_2 = 2NH_3$ + heat
        ii) $2SO_2 + O_2 = 2\ SO_3$ + heat (10 marks)
33. a) What is a buffer? Explain the mechanism of buffer action (6 marks)
    b)Define the terms (i) solubility product and (ii) common ion effect(4 marks)
    c) Discuss the application of common ion effect in cation analysis (5 marks)
34. a) Write notes on acid – base indicators (6 marks)
    b)Explain ferrous iron is estimated by permanganometry (3 marks)
    c)Explain the titration curves of (i) strong acid – strong base (ii) strong acid – weak base (6 marks)
35. a) Illustate Hess's law. (6 marks)
    b)The heats of combustion of $CO_2(g)$, $H_2O(l)$ and $CH_4(g)$ are -396.2, -285.9 and -75.2KJ/mol respectively. Compute the enthalpy of combustion of methatne.(4 marks)
    c) State Kirchoff's equation. Indicate how it is used to evaluate ΔH of a reaction from heat capacity data of reactants and products. (2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**III**
COURSE	**3**
COURSE TITLE	**PHYSICAL AND ANALYTICAL CHEMISTRY - II**
COURSE CODE	**CH 1331.6**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	Expected Course Outcomes *Upon completion of this course, the students will:*	Cognitive Level
1	Understand electromagnetic spectrum and relate energy of radiations to their effect on chemical bonds	U,A
2	Appreciate different types of spectroscopy	U
3	Understand order and molecularity	U
4	Appreciate Arrhenius equation	A
5	Appreciate action of Enzymes	U
6	Understand dialysis	U
7	Comprehend the applications of colloids	A
8	Recognize the importance of Chromatography as a separation technique	A
9	Understand adsorption	U

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: SPECTROSCOPY–I ***9 hours***

Regions of electromagnetic spectrum interaction radiation with matter-
Different types of energy levels in molecules, rotation, vibration and electronic levels-
Various types of molecular spectra, microwave spectroscopy, spectra of diatomic molecules, expression for rotational energy, selection rules, frequency separation, equation for frequency of vibration, expression for vibrational energy, selection rule and calculation of force constant.

MODULE II: CHEMICAL KINETICS AND ENZYME CATALYSIS ***9 hours***

Chemical kinetics, rate of reactions, various factors influencing rate,

Order, molecularity, zero, first, second, third order reactions - derivation of first order kinetics - fractional life time, units of rate constants,

Influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters

Enzyme Catalysis: Classification of enzymes.

General properties of Enzymes

Mechanism of enzyme action- Enzyme substrate interaction, Activation energy, Rate of reaction and Michaelis constant- Michaelis Mentonequation

MODULE III: COLLOIDS ***9 hours***

Colloidal state: Types of colloids, preparation of colloids-

Purification of colloids – ultra filtration and electrodialysis

Properties of colloids : Tyndal effect, , Brownian movement, electrophoresis, electro osmosis, sedimentation and streaming potential, Zeta potential

Stability of colloids, Protective colloids, Hardy- Schultz rule, gold number

Emulsion, gels, application of colloids, delta formation, medicines, sewage disposal, cleansing action of detergents and soaps, Micelles and critical micelle concentration

MODULE IV: CO ORDINATION CHEMISTRY ***9 hours***

Nomenclature, coordination number, Types of Ligands, chelates,
Geometrical, structural and stereo isomerism
Valence Bond theory, bonding in octahedral and tetrahedral complexes,
Strong and weak field ligands, high spin and low spin complexes, magnetic properties, Drawbacks of Valence Bond theory
Application of coordination compounds in qualitative analysis-Complexation reactions in inorganic mixture analysis
Application of complexes in quantitative analysis: Metal-EDTA complexes in complexation titrations and metal complexes in gravimetric analysis

MODULE V: CHROMATOGRAPHY ***9 hours***

Outline study of Adsorption and partition chromatography,

Principle and applications of column, paper, thin layer, ion- exchange and gas chromatography

Principle and applications of HPLC

Rf and Rt value of various chromatographic techniques

Paper chromatographic separation of amino acids and sugars

Separation of a mixture of dyes by column chromatography

MODULE VI: BIOPHYSICAL ANALYSIS ***9 hours***

Osmosis, osmotic pressure, isotonic solution

Determination of molar mass by osmotic pressure method, reverse osmosis

Adsorption – types of adsorption, factors influencing adsorption

Langmuir theory of adsorption

Electrophoresis, Principle and applications of Zone electro phoresis and capillary electro phoresis

REFERENCES

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley
2. Concise Inorganic Chemistry : J. D. Lee, ELBS
3. Inorganic Chemistry : J. E. Huheey
4. Coordination Chemistry : Bosolo and Johns
5. Organic Chemistry : Peter Sykes
6. Organic Chemistry : F. A. Carey, Mc Graw Hill
7. Organic Chemistry : Morrison & Boyd
8. Reaction Mechanism of Organic Chemistry : S. M. Mukherji and S. P. Singh, Mc Millan
9. Spectrscopy Y R Sharma.
10. Advanced Organic Chemistry :Jerry March

Third Semester B.Sc Degree Examination Model question paper

Complementary course for Biochemistry Majors

CH1331.6: PHYSICAL AND ANALYTICAL CHEMISTRY - II

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1. What is Rf?
2. Name the chromatographic method where the components are separated in stacks.
3. What is a colloid?
4. What is the non-linear hybridisation in octahedral complexes?
5. What are chelates?
6. What is the unit of second order rate constant?
7. What is CMC?
8. Write the selection rule for vibrational spectrum ?
9. Write an expression for force constant ?
10. What is frequency factor? (10 x 1 = 10 marks)

SECTION B

*(Answer any **eight** questions. Each question carries 2 marks)*

11. What is zero order reaction? Give an example.
12. Write the Arrhenium equation and explain the terms.
13. What are polydendate ligands? Give an example.
14. Write a note on electrophoresis.
15. State Hardy-Schule's rule.
16. Explain Tyndall effect.
17. What is paper chromatography?
18. What are the various types of molecular spectra?
19. Discuss the various types of energy level in molecule?
20. Write in brief 'ion exchange chromatography'.
21. What are isotonic solutions.
22. What is coordination number? Explain with an example. (8 x 2 = 16 marks)

SECTION C

*(Answer any **six** questions. Each question carries 4 marks)*

23. Differentiate order and molecularity.
24. Explain using valance bond theory, the bonding in tetra hedral complexes ?
25. What are high spin and low spin complexes?
26. How colloids are purified?
27. What are enzymes? Write the general properties of enzymes.
28. Give the expression for the frequency of vibration in vibrational spectroscopy and

explain the terms?

29. Explain the terms – emulstion and gel
30. What are the different types of adsorptions and the factors affecting adsorption?
31. How will you determine bond length in a molecule using microwave spectra?

(6 x 4 = 24 marks)

SECTION D

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

32. a) Write a brief note on the structural isomerism in coordination complexes (6 marks)

    b) Explain the use of EDTA and dimethyl glyoxime in quantitative analysis (6 marks)

    c) Discuss the mechanism of enzyme catalysis. (3 marks)
33. a)Explain the VBT theory in octahedral complexes with examples (6 marks)

    b) Explain the magnetic properties of co-ordination compounds (5 marks)

    c) Advantages and disadvantages backs of VB theory. (4 marks)
34. a) Write a short note on adsorption and partition chromatography. (8 marks)

    b) Discuss the principle and applications of HPLC. (7 marks)
35. a)What is osmosis? How molar mass is determined by osmotic pressure method? (6 marks)

    b) Explain reverse osmosis and its application. (4 marks)

    c) Differentiate between zone and capillary electrophoresis. (5 marks)

(2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY

FOR BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**IV**
COURSE	**4**
COURSE TITLE	**ORGANIC CHEMISTRY AND SPECTROSCOPY**
COURSE CODE	**CH 1431.6**
CREDIT	**3**

L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students ,*	Cognitive Level
1	Relate electron displacements to stability of intermediates	**U,A**
2	Comprehend substitution reactions	**A**
3	Predict R & S notations of optical isomers	**A**
4	Assign E & Z nomenclature to geometrical isomers	**A**
5	Understand the significance of rotation about single bond	**U**
6	Understand the significance of saponification value, iodine value and acid value of oils	**U**
7	Appreciate hetero cyclic compounds and alkaloids	**U**
8	Recognize the role of organo-metallic compounds in medicine	**U**
9	Have a good understanding of different spectroscopic techniques	**U**

*R-Remember, U-Understand, A-Apply, E- Evaluate

MODULE I: MECHANISM IN ORGANIC SUBSTITUTION REACTIONS
9hours

Electron displacement in organic molecules, inductive, electromeric and mesomeric effects, hyper conjugation and steric effect

Bond fission, rate determining step

Nucleophilic substitution of alkyl halides, SN1, SN2 reactions, effect of structure on reactivity as illustrated by methyl, isopropyl and tertiary butyl groups.

Aromatic electrophilic substitution reactions (nitration, halogenations, sulphonation and Friedel Crafts alkyl and acylation) (mechanism not required), directive influence of subtituents on aromatic electrophilic substitution (-OH and -NO2 only)

MODULE II: STEREOCHEMISTRY
9hours

Optical isomerism, chirality, relative and absolute configuration, D- L notation and enantiomers

Optical isomerism in glyceraldehydes, lactic acid and tartaric acid

Diastereo isomers and meso compounds

Cahn-Ingold- Prelog rules, R-S notation for optical isomers containing one or two asymmetric carbon atoms, E and Z nomenclature in aldoximes and ketoximes

Racemic mixture, racemisation and resolution, asymmetric synthesis

Rotational isomerism, rotation about carbon – carbon single bond, conformational analysis of ethane, propane, butane. Cyclohexane, chair and boat conformations, axial and equatorial bonds (Mention only)

MODULE III: OILS, FATS, HETEROCYCLICS AND ALKALOIDS 9hours

Oils and Fats: Occurrence and extraction

Analysis of oils and fats, saponification value, iodine value and acid value

Heterocyclic systems – 5 membered, 6 membered and condensed systems

Structure of pyrrole, Furan , Thiophene and pyridine (no structural elucidation)

Electrophilic substitution in pyrrole, Furan and Thiophene Reactivity and orientation

Electrophilic and nucleophilic substitution reactions in pyridine – Basicity and reduction

Structure of purine and pyramidine bases present in nucleic acids.

Alkaloids, general method of isolation, general properties, physiological action of alkaloids

conine, morphine and nicotine(no structural elucidation expected)

MODULE IV: ORGANO METALLIC COMPOUNDS
9hours

Organo metallic compounds, Definition and classification

Grignard Reagent, preparation and synthetic applications

Ziesels salt-Bonding and Structure, preparation and use

Biological and environmental aspects of organo metallics

Organo metallics in medicine, organo mercury, boron and silicon compounds

Metal carbonyls:Iron and Nickel carbonyls, preparation- Applications – Monds Process

MODULEV:BIO INORGANIC COMPOUNDS 9 hours

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration –

Haemoglobin and myoglobin, mechanism of O_2 – CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems

MODULE VI: SPECTROSCOPY II **9 hours**

Raman spectroscopy, stokes and antistokes lines, quantum theory of Raman spectrum, advantages and disadvantages of Raman spectrum, complementary with IR spectrum, mutual exclusion principle

NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnetic field, chemical shift, spin-spin coupling in ethyl bromide and ethanol, applications, Nuclear Resonance Imaging

ESR spectroscopy introduction and applications

REFERENCES

1. I. L. Finar, Organic Chemistry, Vol. I &II, Longman
2. Jerry March : Advanced Organic Chemistry
3. : Avinash Upadhyay.Kakoli Upadhyay.Nirmalendu Nath : Bio Physical Chemistry Principles and techniques
4. B K Sharma: Spectroscopy
5. Y R Sharma: Spectroscopy
6. J.E.Huheey, Inorganic Chemistry, Pearson.

IV Semester B.Sc Degree Examination Model question paper

Complementary course for Bio-Chemistry Majors

Course Code CH1431.6 Credit 3

ORGANIC CHEMISTRY AND SPECTROSCOPY

(2020 admission onwards)

Time: Three Hours **Maximum Marks: 80**

SECTION A

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

1.What is rate determining step?

2.Define Racemic mixture.

3. Represent the configurations of D and L glyceraldehyde.

4. Write an example for volatile oil .

5.What is Zieses' salt?

6.Define Iodine value.

7.Write an example for volatile oil .

8. Give the formula of iron and nickel carbonyls.

9. What is esr spectroscopy?

10. **The metal part in cytochrome.**

SECTION B

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

11. How benzene is nitrated? Give chemical equation.

12. What is steric effect?

13. Discuss the importance of Morphine.

14. Which of the following are optically active ? Why?

2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane

15. Give two differences between enantiomers and diastereoisomers.

16. What is Mond's process?

17. How are alkaloids extracted from natural sources?

18. Write any two organosilicon compounds used in medicine.

19. State mutual exclusion principle.

20. Which compound is used as standard in nmr spectroscopy? Why?

21. What is carbon cycle?

22. Explain saponification value and acid value.

SECTION C

(Answer any six questions. Each question carries 4 marks)

23. Discuss the optical isomerism of tartaric acid.

24. Illustrate the directive influence of –NO2 group in aromatic electrophilic substitituion.

25. Distinguish between inductive and electromeric effect.

26. Comment on the classification of heterocyclics.

27. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.

28. How organometallics are classified?

29. Distinguish between Stokes and antistokes lines.

30. Discuss the role of haemoglobin and myoglobin inO2-CO2 transportation with mechanism

31. Differentiate fats and oils.

SECTION D

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

32. (a)Discuss the mechanism of SN1 and SN2 reactions (6 marks)

(b)Effect of structure of alkyl group on SN1 and SN2 reactions(5 marks)

(c)What is Friedel-Crafts alkyl and acylation. (4 marks)

33. (a) Why furan undergoes electrophilic substitution at 3-position.(4 marks)

(b) Discuss the important electrophilic substitution reactions of furan (6 marks)

(c)Write the structure of purine and pyrimidine bases (5 marks)

34. (a)What is resolution? Explain any three methods of resolution. (7 marks)

(b)What are meso compounds? Are they optical active? Explain with a suitable example.(4 marks)

(c)Discuss the conformational analysis of butane. (4 marks)

35. (a) What is Grignard reagent? How is it prepared? (3 marks)

(b) How Grignard reagent is useful to synthesis primary, secondary and tertiary alcohols (3 marks)

(c)Discuss the nmr spectrum of ethyl bromide. (5 marks)

(d) Explain chemical shift (3 marks) (2 x 15 = 30 marks)

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF BIOCHEMISTRY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR BIOCHEMISTRY**
COURSE CODE	**CH 1432.6**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A
	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallise	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR BIOCHEMISTRY MAJORS

Course Code CH1432 .6 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY (FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**I**
COURSE	**1**
COURSE NAME	**GENERAL CHEMISTRY - I**
COURSE CODE	CH1131 .7
Credit	2
HOURS	36
L-T-P	2-0-2

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Discuss the Bohr atom model and represent electronic configuration of elements	R,U
2	Predict the shape of molecules	A
3	Explain the significance of hydrogen bonding	U
4	Discuss the theory of volumetric analysis	U
5	Point out the major sources of air and water pollution and its environmental impact.	U

MODULE I – ATOMIC STRUCTURE (9 HRS)

Atomic spectrum of hydrogen - different series, Rydberg equation.

Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation.

Schrodinger wave equation (mention only, no derivation), concept of orbitals.

Quantum numbers and their significances.

Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.

Electronic configuration of lanthanides and actinides, Lanthanide contraction

MODULE II – CHEMICAL BONDING (9 HRS)

Energetics of ionic bond formation – Born-Haber cycle. Fajan's rule.

Hybridisation and shape of molecules – sp (BeCl2), sp^2(BF3) , sp^3 (CH4), sp^3d(PCl5), sp^3d^2 (SF6) and sp^3d^3 (IF7)

hybridisation with examples.

VSEPR theory, regular and irregular geometry, H2O, NH3, XeF2, XeF4.

Hydrogen bond – inter and intra molecular – its consequences on boiling point and

volatility. Importance of hydrogen bonding in biomolecules – Proteins and nucleic acids.

Ionic character of covalent bond – Polar and non polar covalent compounds.

MODULE III – ENVIRONMENTAL CHEMISTRY (9HRS)

Nature of environmental threats and role of chemistry.

Air pollution – Air pollutants and their sources, toxic effect of CO, acid rain.

Green house effect, ozone layer and its depletion.

Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents.

Treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.

Dissolved oxygen-BOD,COD analysis.

MODULE IV – ANALYTICAL PRINCIPLES (9 HRS)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity.

Theory of acid-base titrations, permagnometric and dichrometric titrations,

iodometry and complexometric titrations.

Theory of acid-base indicator – redox indicators.

Principles of colorimetry – estimation of biomolecules - glucose and chlorophyll.

Text books/References:

1. B.R.Puri, L.R.Sharma and P.S.Kalia “Inorganic chemistry”,
2. A.I.Vogel “A text book of Quantitative analysis”
3. Day & Underwood. “Qunatitative analysis: laboratory manual”:
4. G.S.Manku. “Theoretical Principles of Inorganic Chemistry”:
7. S. K. Banerji, “Environmental Chemistry”.
8. A. K. De “Environmental Chemistry - An introduction”
9. B. K. Sharma “Air Pollution”.

UNIVERSITY OF KERALA

I Semester Bsc Degree Examination Model Question Paper
Complementary Chemistry Course for Microbiology Majors

Course Code CH1131.7 Credit 2

GENERAL CHEMISTRY - I

(2020 Admission onwards)

Time: Three Hours Maximum Marks: 80

Section A

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

1. Give the electronic configuration of Copper (atomic umber 29)
2. The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Identify the hybridization in $BeCl_2$.
5. Give the structure of XeF_2.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Answer any 8 questions from the following. Each question carries two marks

11. What is Bohr Bury's rule?

12. Write down the Schrodinger Equation and explain the terms involved.

13. Explain the failures of Bohr's theory?

14. What are the limitations of VSEPR Theory?

15. What are polar and non polar covalent bonds?

16. Which is more volatile, o-nitro phenol or p-nitro phenol? Why?

17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?

19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?

20. Which are green house gases? Mention their sources.

21. What is reverse osmosis? How it is useful in the purification of waste water?

22. What are chief factors responsible for water pollution?

SECTION-C

Answer any 6 questions from the following. Each question carries four marks.

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?

24. Explain the stability of half filled and completely filled orbitals.

25. Give an account of permanganometric titrations.

26. Discuss the theory of Acid – Base indicators.

27. Explain the energetic of ionic bond formation.

28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.

29. Explain Fajan's rule.

30. Write a note on agricultural pollution.

31. Explain briefly the different methods for the treatment of industrial waste water.

SECTION-D

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

32. (a) Discuss Bohr Theory, highlighting its merits . (6 marks)

(b)What are quantum numbers? Give its significance. (3 marks)

(c) Explain various rules regarding electronic configuration. (6 marks)

33. (a) Discuss the titration curves for the titration of strong acid with strong base and

weak acid with strong base. (6 marks)

(b) Explain the theory of redox indicators. (5 marks)

(c) State and explain Beer – Lambert Law. (4marks)

34. (a) Write a note on Hydrogen bonding . (4 maks)

(b) Discuss the consequences of hydrogen bonding. (5 marks)

(b) Account for the bond angle difference in NH3 and H2O using VSEPR theory.(5

marks)

(c) Calculate the bond order of O_2, O_2^{2+} and O_2^{2-} and arrange them in the increasing order of stability.(4 marks)

35. (a) Discuss the formation and importance of ozone layer. (5 marks)

(b) What is meant by pollution and pollutants? Describe the various air pollutants and their sources. (5 marks)

(c) What is acid rain? How is it happens? Write its impact on environment. (5 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY (FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**II**
COURSE	**2**

COURSE NAME	GENERAL CHEMISTRY II
COURSE CODE-	CH1231 .7
Credit	2
HOURS	36
L-T-P	2-0-2

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Discuss the stereochemistry of organic compounds	R,U
2	Discuss radioactivity and its applications	A
3	Summarize the chemistry of coordinate compounds	U
4	Explain the role of chlorophyll, haemoglobin, myoglobin, and elements in biological functions.	U
5	Solve numerical problems on radioactivity	U
6	Develop scientific attitudes curiosity against the biological effect of radiations	

MODULE I – STEREOCHEMISTRY (9 HRS)

Optical isomerism, chirality, enatiomers, diastereoisomers, racemisation and resolution.

Relative and absolute configuration – CIP rules (D- & L- Glyceraldehyde, D- & L- lactic acid and +,- and meso tartaric acid only)

Asymmetric synthesis, Enantiomeric excess.

Geometrical isomerism, E and Z nomenclature to Aldoximes, ketoximes, simple alkenes, maleic and fumaric acid.

Rotational isomerism. Rotation about carbon – carbon single bond,

conformation of ethane, butane, cyclohexane, axial and equatorial bonds.

MODULE II- RADIOACTIVITY AND NUCLEAR CHEMISTRY (9 HRS)

Radioactive decay series, Radioactive equilibrium, Average life, Half life.

Detection of radio activity-Geiger Muller Counter, Wilson cloud chamber.

Units of radioactivity-Curie and Rutherford, Units of radiations.

Nuclear Chemistry-stability of nucleus, n/p ratio.

Artificial transmutation and radioactivity, mass defect, binding energy.

Applications of radio activity- in medicine and agriculture.

Biological effects of radiation, pathological and genetic damage.

MODULE III- CO-ORDINATION CHEMISTRY AND SECONDARY BOND FORCES (9 HRS)

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory.

Crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties.

Application in qualitative and quantitative analysis.

Secondary bond forces in molecules – Ion-dipole, dipole-dipole, ion-induced dipole, dipole-induced dipole and induced dipole-induced dipole interactions.

MODULE IV – HETEROCYCLIC AND BIO INORGANIC COMPOUNDS (9HRS)

Structure of furan, pyrrole, thiophene, 1,3-diazole, 1,3-thiozole, pyridine, 1,3-diazine, indole, quinoline, isoquinoline, purine and pyramidine bases.(structure only)

Aromaticity of five and six membered heterocyclics.

Metalloporphyrins – cytochromes, chlorophyll, photosynthesis and respiration, haemoglobin and myoglobin, mechanism of O2 – CO2

transportation.

Biological fixation of nitrogen

Carbon fixation and carbon cycle.

Role of alkali and alkaline earth metals in biological systems

Biological functions and toxicity of Cr, Mn, Ni, Cu, Se, Mo, Co ,Fe & Zn.(mention only)

Text Books /References

1. Bosolo and Johns Co-ordination Chemistry
2. Rochoco, Chemistry of Organometallics
3. J.D. Lee, Concise Inorganic Chemistry
4. Puri, Sharma and Kalia "Inorganic Chemistry"
5. A.D. Madan Modern Inorganic Chemistry

UNIVERSITY OF KERALA

II Semester Bsc Degree Examination Model Question Paper

Complementary Chemistry Course for Microbiology Majors

Course Code CH1231.7 Credit 2

GENERAL CHEMISTRY II

(2020 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

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

1. What is chirality?
2. Draw the structure of D-glyceraldehyde and L-glyceraldehyde.
3. What are conformers?
4. What are alpha particles?

5. Define the term radioactivity.
6. Give an example for hexadendate ligand.
7. What are low spin complexes?
8. What do you mean by chelate?
9. Draw the structure of furan and pyrrole?
10. Give an example of anaerobic respiration.

SECTION-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is racemisation? Comment on its optical activity.
12. What are diastereoisomers? Give examples.
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. Mention the biological functions of Cr and Zn?
22. What is the role of chlorophyll in photosynthesis?

SECTION-C

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

23. Discuss the geometrical isomerism of maleic and fumaric acid. Also assign E and Z notation.
24. Explain the conformarism of cyclohexane.
25. One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How Long will it take for the radioactivity to fall to 10% of the initial value?
26. Explain the relation between nuclear stability and n/p ratio.

27. Write the biological effects of radiation

.

28. Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.

29. Explain the magnetic properties of octahedral complexes with suitable examples.

30. Discuss the aromaticity of heterocyclic compounds.

31. Metal ions play a variety of roles in biological systems. Explain

SECTION-D

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

32.(a) What is resolution? Explain any three methods of resolution (7 marks)

(b) Apply CIP rules to find out the absolute configuration of + & - lactic acid

(5marks).

(c) Discuss asymmetric synthesis with an example. (3 marks)

33.(a) Discuss the applications of radioactivity in medicine and agriculture (5 marks)

(b) Describe any one method of detecting radioactivity (5 marks)

(c) Explain artificial radioactivity with suitable examples. (5 marks)

34. (a) Write a note on Crystal Field Theory. (5 marks)

(b) Explain the applications of complexes in qualitative analysis. (5marks)

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

35. (a) Give brief outline of carbon cycle. (5 marks)

(b) Explain nitrogen Fixation. (5 marks)

(c) Write a short note on hemoglobin. (5 marks)

UNIVERSITY OF KERALA
SYLLABUS OF COMPLEMENTARYCHEMISTRY
(FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**III**
COURSE	**3**
COURSE NAME	BIOMOLECULES & BIOPHYSICAL CHEMISTRY - I
COURSE CODE-	CH1331 .7
Credit	2
HOURS	**54**
L-T-P	3-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students,*	**Cognitive Level**
1	Discuss the chemistry and structure of biologically important carbohydrates	U
2	Describe the synthesis of amino acids and polypeptides	A
3	Understand the structure of protein and nucleic acids	U
4	Explain the classification of lipids, their structure and biological importance.	U
5	Understand the role of buffers, importance of osmosis and to prepare standard solutions.	U
6	Explain the basic concepts of kinetics of chemical reactions	U

MODULE I – CARBOHYDRATES (12 HOURS)

Classification, configuration of D & L glyceraldehydes. Structure of ribose, 2-deoxy ribose, glucose, fructose, mannose and galactose.

Properties of glucose and fructose - due to functional groups - hydroxyl, aldehyde and ketone, action of acids and alkali on sugars, Reducing actions of sugars.

Pyranoside structures of glucose and fructose.

Furanoside structure of fructose (structure elucidation not expected).

Mutarotation and epimerization.

Glycosides and amino sugars.

Structure and biological importance of disaccharides - sucrose, lactose, maltose and cellobiose**.** Inversion of sucrose.

Structure and important properties of the following structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen).

Glycosaminoglycans- heparin, hyaluronic acid.

MODULE II – AMINO ACIDS AND PROTEINS (12 HRS)

Amino acids -Classification and properties, Essential and non essential amino acids, zwitter ion, isoelectric point

Synthesis of amino acids - glycine, alanine and tryptophan .

Polypeptides and proteins - peptide linkage.

Peptide synthesis - Carbobenzoxy, Sheehan and solid phase synthesis

Proteins - primary, secondary, tertiary and quarternary structure of proteins.

Denaturation and colour reactions of proteins.

RNA and DNA – Structure of purines and pyrimidines, nucleosides, nucleotides, phosphodiester linkages.

Hydrolysis of nucleoproteins, structure of nucleic acids. their biological role.

Replication of DNA.

MODULE III – LIPIDS (12 HOURS)

Lipids: Definition, basic ideas about the biochemical functions of lipids.

Classification of lipids with examples, classification of fatty acids, physical and chemical properties of fatty acids.

Structure of the following fatty acids- stearic acid, oleic acid, linoleic acid, arachidonic acid. Structure of triacylglycerol.

Saponification number, acid number and iodine number of fats.

Essential and non-essential fatty acids with examples.

Compound lipids: membrane lipids- Structure and functions of phospholipids- phosphatidic acid, lecithin, cephalin, and phosphatidyl serine, Functions of Sphingolipids.

Steroids: Strucutre and functions of cholesterol and ergosterol.

MODULE IV – ACIDS, BASES AND BUFFERS (6 HRS)

Dissociation of water, ionic product of water, concepts of pH, pOH, simple numerical problems of pH.

Determination of pH using indicators, pH meter and theoretical calculations.

Dissociation of weak acids and electrolytes, Bronsted and Lewis theory of acids and bases,

Meaning of Ka and pKa values,

Buffers: buffer action, buffers in biological system,

Henderson -Hasselbach equation with derivation, simple numerical problems involving application of this equation.

MODULE V: SOLUTIONS (6H)

Meaning of normality, molarity, molality, percentage solution, mole fractions, simple numerical problems from the above, Fundamental principles of diffusion and osmosis, biological importance of osmosis. Isotonic, hypotonic and hypertonic solutions.

MODULE VI - CHEMICAL KINETICS (6HRS)

Rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions. Rate determining step.

Derivation of first order kinetics - fractional life time, units of rate constants.

Influence of temperature on reaction rates, Arrhenius equation,

Calculation of Arrhenius parameters.

REFERENCES

1) Dr.U.Satyanarayana and Dr.U.Chakrapani,Biochemistry, Books and Allied (P) Ltd
2) J.L.Jain, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry, , S.Chand & Co. Ltd.
3) RK Murray, DK Granner, PA Mayers, VW Rodwell, Harper's Biochemistry, Prentiace-Hall International Editions.
4) Sharma,Madan and Pahania, Principles of Physical Chemistry, Vishal Publishing Co.

UNIVERSITY OF KERALA

III Semester Bsc Degree Examination Model Question Paper
Complementary Chemistry Course for Microbiology Majors

Course Code CH1331.7 Credit 2

BIOMOLECULES & BIOPHYSICAL CHEMISTRY - I

(2020 Admission onwards)

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1) Write the epimer of D-Glucose.
2) What are polysaccharides?
3) What are zwitter ions?
4) Relationship between the base sequence in DNA and the amino acid sequence in protein is known as ……..
5) Write the structure of tryptophan.
6) Name the purine bases present in DNA.
7) Explain the term rate determining step.
8) Mention about the concepts of pH& pOH.
9) Prepare 2M ,250 ml NaOH solution.(mol wt of NaOH = 40)
10) What is unit of first order reaction? (10x1=10 marks)

SECTION B

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

11) Draw the structure of cellulose.
12) Explain inversion of cane sugar.
13) What is Tollen's reagent. Write its importance.
14) Explain denaturation of protein.
15) Differentiate essential and non-essential amino acids?
16) Name the products of hydrolysis of nucleoproteins.
17) Write the functions of cholesterol.
18) Explain saponification value.
19) Calculate the pH of 0.001M HCl.
20) What is buffer?
21) What is a first order reaction? Give an example.
22) Write Arrhenius equation and explain the terms. (8x2=16 marks)

SECTION C

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

23) Write a short note of glycosaminoglycans.
24) Give the chemical properties of glucose due to hydroxyl and carbonyl functional groups.
25) Explain mutarotation and epimerization.
26) Explain the following denaturation and colour reactions of protein.
27) Write the structure and functions of cholesterol and ergosterol.
28) Differentiate Saponification number and iodine number. Write its importance.
29) Derive first order rate equation.
30) Explain Bronsted theory of acids and bases.
31) Write any one method of synthesizing glycine and tryptophan (6x4=24marks)

SECTION D

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

32) (a) Discuss the pyranoside structure of glucose.

(b) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine

(iii) CH_3OH and dry Conc.HCl. (iv) Tollen's reagent.

(c) Write a short note on storage polysaccharides. (6+4+5)

33) (a) What are lipids? Discuss the biological functions of lipids.

(b) How fatty acids are classified? Discuss it with examples and structure.

(c) Write short notes on lecithin and cephalin. (4+6+5)

34) (a) Explain two methods of synthesizing peptides.

(b) Discuss primary and secondary structure of proteins.

(c) Discuss the biological role of DNA. (5+5+5)

35) (a) Derive Henderson-Hasselbach equation. Write the importance of the equation?

(b) Explicit the importance of osmosis in biological systems.

(c) Discuss the various factors influencing rate of reaction. (6+4+5)

(2x15=30 marks)

UNIVERSITY OF KERALA

SYLLABUS OF COMPLEMENTARYCHEMISTRY (FOR MICROBIOLOGY MAJORS)

(2020 admission onwards)

SEMESTER	**IV**
COURSE	**4**
COURSE NAME	**BIOMOLECULES & BIOPHYSICAL CHEMISTRY - II**
COURSE CODE-	CH1431 .7
Credit	2

HOURS	**54**
L-T-P	3-0-2

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Discuss the classification of enzymes and their biological importance.	U
2	Outline the metabolism of carbohydrates, fatty acids and proteins.	U
3	Explain the importance of UV, IR and NMR spectroscopic techniques as analytical tool.	U
4	Explain the basic concepts of thermodynamics and relevance of themodynamics in biological processes.	U
5	Discuss the classification of colloids and their synthesis and applications.	U

MODULE I – INTRODUCTION TO ENZYMES (12HRS)

Enzymes – Chemical nature and Features of active site.

Enzyme Specificity – Stereo, reaction, substrate and broad specificity.

Enzyme Commission system of classification and nomenclature of enzymes: six major classes of enzymes with one example each.

Coenzymes and their functions - NAD, NADP+, FAD, FMN, lipoic acid, pyridoxal phosphate, biotin and cyanocobalamin. Ribozymes,

Measurement and expression of enzyme activity, Definition of IU,

katals, enzyme turnover number .

Isoenzymes- Lactate dehydrogenase

Applications of enzymes – Enzymes as therapeutic agents, as analytical reagents, immobilized enzymes.

MODULE II : ENZYME KINETICS (6H)

Factors affecting enzyme catalysed reactions - effect of substrate concentration, enzyme concentration, temperature, pH and activators.

Mechanism of Enzyme action - Activation energy, Interaction between enzyme and substrate- lock and key model, induced fit model.

Enzyme kinetics - Km and its significance, Michaelis Menton equation (without derivation), Lineweaver- Burk plot.

Significance of Km and Vm values.

MODULE III: INTRODUCTION TO METABOLISM (9HRS)

Metabolism- catabolism and anabolism

Metabolism of carbohydrates – Glycolysis and citric acid cycle, Electron transport chain and Oxidative phosphorylation.

Glycogenesis and glycogenolysis, Gluconeogenesis (Mention only)

Metabolism of lipids - Metabolism of triglycerides, Outline study of β-oxidation of saturated and unsaturated fatty acids.

Metabolism of amino acids – Proteolysis, Urea cycle.

MODULE IV – ORGANIC SPECTROSCOPY (9 HRS)

Spectroscopic techniques: Principle and applications of UV and Visible spectroscopy – types of electronic transitions, concept of chromophore and auxochrome – red and blue shifts – applications.

IR spectroscopy – Molecular vibrations, vibrational frequency-bond strength relation, Functional group and finger print region – group frequencies, effect of hydrogen bonding on –OH stretching frequency.

NMR spectroscopy – nuclear spin, principle of NMR, chemical shift, spin-spin interation.

PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI.

MODULE V: BIOENERGETICS (9HRS)

Basic concepts – System – surroundings – open, closed and isolated systems – Isothermal

– isochoric and isobaric process.

Biochemical thermodynamics, first and second law of thermodynamics, Enthalpy, Entropy and Free energy.

Criteria for reversible and irreversible process - Gibbs free energy equation.

Relationship between standard free energy change and equilibrium constant.

Standard free energy changes at pH 7.0 ($\Delta G'$), additive nature of $\Delta G'$, ATP as universal currency of free energy in biological systems.

MODULE VI- COLLOIDS (9HRS)

Meaning of true solution, colloidal solution, and coarse suspension, distinction between lyophilic and lyophobic sols, Fundamental study of Donnan equilibrium- application in biological system, membrane permeability, methods of preparation of colloidal solution, separation of colloidal solutions, elementary study of charge on colloids, Tyndall effect, emulsion and emulsifying agents, application of colloidal chemistry.

References:-

5) Biochemistry, Dr,U.Satyanarayana and Dr.U.Chakrapani, Books and Allied (P) Ltd

6) Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, S.Chand & Co. Ltd.

7) Harper's Biochemistry, RK Murray, DK Granner, PA Mayers, VW Rodwell, Prentiace-Hall International Editions.

8) Principles of Physical Chemistry, Sharma,Madan and Pahania, Vishal Publishing Co.

UNIVERSITY OF KERALA

IV Semester Bsc Degree Examination Model Question Paper
Complementary Chemistry Course for Microbiology Majors

Course Code CH1431.7 Credit 2

BIOMOLECULES & BIOPHYSICAL CHEMISTRY - II

(2020 Admission onwards)

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1. What is holoenzyme?
2. What is LB plot?
3. What is enzyme turnover number?
4. What is glycogenesis?
5. Define catabolism
6. Write the mathematical form of Beer Lamber's Law.
7. Write the useful region in IR spectroscopy.
8. Define open and closed systems.
9. What is entropy?
10. What is a colloidal solution. (10x1=10 marks)

SECTION B

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

11. Write down any 4 industrial uses of enzymes?
12. Define IU and katal?
13. Explain the significance of km value?
14. Differentiate catabolism and anabolism.
15. What is phosphorylation?
16. What are chromophores? Give examples.
17. Write the stretching frequency of (i) carbonyl group and (ii) free

–OH group.

18. Differentiate glycogenolysis and Gluconeogenesis

19. State and explain first law of thermodynamics.

20. Distinguish isothermal and isobaric process.

21. Explain Tyndall effect.

22. What are emulsifying agents? Give examples. (8x2=16 marks)

SECTION C

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

23. What is Michaelis Menton equation? Explain?

24. Briefly explain factors affecting velocity of enzyme catalyzed reactions?

25. What are co-enzymes? Write any two co-enzymes and their functions.

26. Illustrate urea cycle.

27. (i) What is fingerprint region? (ii) Comment on the influence of hydrogen bonding on O-H stretching frequency.

28. What is chemical shift? Explain the factors influencing chemical shift.

29. Describe any two methods of preparation of colloidal solution.

30. Derive the relationship between standard free energy change and equilibrium constant.

31) Differentiate lyophilic and lyophobic colloids. (6x4=24marks)

SECTION D

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

32. (a) Give an account of classification of enzymes?

(b) Write down any 4 industrial uses of enzymes.

(c) Explain immobilization of enzymes? (8+4+3)

33. (a) Explain the reaction sequences happening in kerb's cycle?

(d) Give an account on saturated fatty acid oxidation. (8+7)

31. (a) Explain the principle of NMR spectroscopy.

(d) What is spin-spin interaction? Explain with an example

(e) Discuss on the applications of UV-Vis spectroscopy

(6+6+3)

32. (a) Comment on the statement "ATP as universal currency of free energy in biological systems"

(d) Explain the importance of free energy to predict the feasibility of reactions.

(e) Discuss the various applicatiaons of colloids. (6+4+5) (2x15=30 marks)

UNIVERSITY OF KERALA
SYLLABUS OF LAB COURSE IN CHEMISTRY
FOR STUDENTS OF MICROBIOLOGY MAJORS

2020 Admission onwards

SEMESTER	**I,II,III &IV**
COURSE NAME	**COURSE V : LAB COURSE FOR MICROBIOLOGY**
COURSE CODE	**CH 1432.7**
CREDIT	**2**
L-T-P	**0-0-2**
TOTAL HOURS	**36**

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	**Cognitive Level**
	Obey Lab safety instructions, develop qualities of punctuality, regularity and scientific attitude, out look and scientific temper (GOOD LAB PRACTICES)	R,U,A

	Develop skill in safe handling of chemicals, take precaution against accidents and follow safety measures	U,A
	Develop skill in observation, prediction and interpretation of reactions	U,A
	Prepare organic compounds, Purify and recrystallize	U,A
	Develop skill in weight calculation for preparing standard solutions	E,A
	Perform volumetric titrations under acidimetry-alkalimetry, permanganometry, dichrometry, iodimetry-iodometry,cerimetry, argentometry and complexometry	A
	Conduct chromatographic separation of mixtures	A

SYLLABUS FOR LABORATORY COURSE

FOR COMPLEMENTARY CHEMISTRY FOR MICROBIOLOGY MAJORS

Course Code CH1432 .7 Credit 2

I.QUALITATIVE ANALYSIS

Systematic analysis with a view to identify the organic compound (aromatic – aliphatic, saturated – unsaturated, detection of elements and detection of functional groups) – glucose, alcohols, phenols, halogen compounds, nitro compounds, amino compounds, aldehydes, ketones, carboxylic acids, amides, urea, thiourea and esters. Only monofunctional compounds are to be given. A student has to analyse at least twelve organic compounds.

II.ORGANIC PREPARATIONS

1. Acetanilide from aniline
2. Metadinitrobenzene from nitro benzene
3. Benzoic acid from benzyl chloride

III.VOLUMETRIC ANALYSIS

A. Acidimetry and Alkalimetry

a. Preparation and standardization of 0.05N HCl using sodium carbonate as primary standard

b. Estimation of a strong base and a weak base using standardized HCl

c. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. HCl

d. Preparation and standardization of 0.05N NaOH using oxalic acid as primary standard

e. Estimation of a strong acids using standardized NaOH

f. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardization of $KMnO_4$ by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c.Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

a. Preparation of Std. $K_2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

b. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate

b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

a. Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution.

b. Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

A student has to carry out at least twelve experiments in this class.

IV.GRAVIMETRIC ANALYSIS

1. Estimation of water of hydration in barium chloride crystals
2. Estimation of barium in barium chloride solution.

V.CHROMATOGRAPHY

TLC of simple organic compounds- phenol, napthol, nitrobenzene

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1^{st} ,2^{nd} , 3^{rd} and 4^{th} semesters