UNIVERSITY OF KERALA

SCHEME AND SYLLABI OF COMPLEMENTARY CHEMISTRY COURSE FOR BIOCHEMISTRY MAJORS 2020 ADMISSION ONWARDS

The Complementary Chemistry Syllabus has been designed to motivate students of Biochemistry 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 COURSE 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.

MODE OF EVALUATION

Evaluation of each semester course shall involve Continuous Evaluation (CE) and End Semester Evaluation (ESE) . The Continuous evaluation will have 20 marks and will be done continuously during the semester. The End semester evaluation will have 80 marks and will be done at the end of each semester. 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 corresponding CE are calculated from all the semesters in which there is attendance for laboratory sessions. The certified record is compulsory for the Lab course ESE.Lab record of experiments certified by the tutor and HoD should be submitted for verification by the External Examiner at the ESE.

SYLLABUS OF COMPLEMENTARY CHEMISTRY COURSES (FOR BIOCHEMISTRY MAJORS)

DISTRIBUTUIN OF HOURS One Semester - 18Weeks

Semester	Hours/Week		No. of Credits	Course Code	Instructional Hours
	Theory(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 9 hours

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

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 SF6?
3. Which is bigger in size, Na or Na+? Why?
4. Which is steam volatile- o-nitro phenol or p-nitro phenol?
5. BeCl2 is linear. Is it polar or non polar?
6. What is meant by transmutation?
7. N ame two units of radioactivity?
8. What is meant by half life period?
9. Define a system?
10. What is an isochoric process? (10x1 = 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 binding energy?
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 (6x4 = 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. (8marks)
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?(5 Marks)

34.a)What are the applications of radioactivity in medicine and agriculture? (6marks)
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) (4 Marks)

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)

(2x15= 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 : NH4Cl/NH4OH in cation analysis, salting out process

MODULE III - ANALYTICAL PRINCIPLES 9hours

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 a standard solution?
7. Define enthalpy of combustion?
8. What is Cp?
9. What is the ionic product of water?
10. Define equilibrium constant. (10x1 = 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 Na_2CO_3 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. (AG^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.

$H_2(g) \longrightarrow 2\ H(g);\ \Delta H_1 = 436.08KJ$

$O2(g) \longrightarrow 2\ O(g);\ \Delta H_2 = 495.17KJ$

$H_2(g) + ½\ O_2(g) \longrightarrow H_2O\ (g)\ ;\ \Delta H_3 = -241.84KJ$ (6 x 4 = 24 marks)

SECTION D

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

32.a) Derive relation between Kp and Kc (5 marks)

b) Apply Le-Chatlier principle for the following equilibria

i) $N_2 + 3\ H_2 \rightarrow 2NH_3 + heat$

ii) $2SO_2 + O_2 \rightarrow 2\ SO_3 + heat$ (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 AH of a reaction from heat capacity data of reactants and a) What is a buffer? Explain the mechanism of buffer action (5 marks)

(2x15=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.

MODULEII: 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 Menton equation

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)

SECTION A

(Answer all questions. Each question carries 1 mark)

Time: Three Hours Maximum Marks:80

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? (10x 1 = 10 marks)

SECTION B

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

11. What is zero order reaction? Give an example.

12. Write the Arrhenium equation and explain the terms.

13. What are polydendate ligands? Give an example.

14. Write a note on electrophoresis.

15. State Hardy-Schule's rule.

16. Explain Tyndall effect.

17. What is paper chromatography?

18. What are the various types of molecular spectra?

19. Discuss the various types of energy level in molecule?

20. Write in brief 'ion exchange chromatography'.

21. What are isotonic solutions.

22. What is coordination number? Explain with an example. (8 x 2 = 16 marks)

SECTION C

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

23. Differentiate order and molecularity.

24. Explain using valance bond theory, the bonding in tetra hedral complexes ?

25. What are high spin and low spin complexes?
26. How colloids are purified?
27. What are enzymes? Write the general properties of enzymes.
28. Give the expression for the frequency of vibration in vibrational spectroscopy and explain the terms?
29. Explain the terms - emulstion and gel
30. What are the different types of adsorptions and the factors affecting adsorption?
31. How will you determine bond length in a molecule using microwave spectra?

(6 x 4 = 24 marks)

SECTION D

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

32. a) Write a brief note on the structural isomerism in coordination complexes (6 marks)

b) Explain the use of EDTA and dimethyl glyoxime in quantitative analysis (6 marks)

c) Discuss the mechanism of enzyme catalysis. (3 marks)

33. a)Explain the VBT theory in octahedral complexes with examples (6 marks)
b) Explain the magnetic properties of co-ordination compounds (5 marks)
c) Advantages and disadvantages backs of VB theory. (4 marks)

34. a) Write a short note on adsorption and partition chromatography. (8 marks)
b) Discuss the principle and applications of HPLC. (7 marks)

35. a)What is osmosis? How molar mass is determined by osmotic pressure method?

(6 marks)

b) Explain reverse osmosis and its application. (4 marks)

c) Differentiate between zone and capillary electrophoresis. (5 marks)

(2 x 15 = 30 marks)

SYLLABUS OF COMPLEMENTARY CHEMISTRY FOR

BIOCHEMISTRY MAJORS 2020 Admission onwards

SEMESTER	**IV**
COURSE	**4**
COURSE TITLE	**ORGANIC CHEMISTRY AND SPECTROSCOPY**
COURSE CODE	**CH 1431.6**
CREDIT	**3**
L-T-P	**3-0-2**
TOTAL HOURS	**54**

CO No.	COURSE OUTCOME *Upon completion of this course, the students,*	Cognitive Level
1	Relate electron displacements to stability of intermediates	U,A
2	Comprehend substitution reactions	A
3	Predict R & S notations of optical isomers	A
4	Assign E & Z nomenclature to geometrical isomers	A
5	Understand the significance of rotation about single bond	U
6	Understand the significance of saponification value, iodine value and acid value of oils	U
7	Appreciate hetero cyclic compounds and alkaloids	U
8	Recognize the role of organo-metallic compounds in medicine	U
9	Have a good understanding of different spectroscopic techniques	U

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

MODULE I: MECHANISM IN ORGANIC SUBSTITUTION REACTIONS 9hours

Electron displacement in organic molecules, inductive, electromeric and mesomeric effects, hyper conjugation and steric effect Bond fission, rate determining step

Nucleophilic substitution of alkyl halides, SN1, SN2 reactions, effect of structure on reactivity as illustrated by methyl, isopropyl and tertiary butyl groups.

Aromatic electrophilic substitution reactions (nitration, halogenations, sulphonation and Friedel Crafts alkyl and acylation) (mechanism not required), directive influence of subtituents on aromatic electrophilic substitution (-OH and -NO2 only)

MODULE II: STEREOCHEMISTRY 9hours

Optical isomerism, chirality, relative and absolute configuration, D- L notation and enantiomers

Optical isomerism in glyceraldehydes, lactic acid and tartaric acid Diastereo isomers and meso compounds

Cahn-Ingold- Prelog rules, R-S notation for optical isomers containing one or two asymmetric carbon atoms, E and Z nomenclature in aldoximes and ketoximes

Racemic mixture, racemisation and resolution, asymmetric synthesis

Rotational isomerism, rotation about carbon - carbon single bond, conformational analysis of ethane, propane, butane. Cyclohexane, chair and boat conformations, axial and equatorial bonds (Mention only)

MODULE III: OILS, FATS, HETEROCYCLICS AND ALKALOIDS 9hours

Oils and Fats: Occurrence and extraction

Analysis of oils and fats, saponification value, iodine value and acid value

Heterocyclic systems - 5 membered, 6 membered and condensed systems

Structure of pyrrole, Furan , Thiophene and pyridine (no structural elucidation)

Electrophilic substitution in pyrrole, Furan and Thiophene Reactivity and orientation

Electrophilic and nucleophilic substitution reactions in pyridine - Basicity and reduction

Structure of purine and pyramidine bases present in nucleic acids.

Alkaloids, general method of isolation, general properties, physiological action of alkaloids conine, morphine and nicotine(no structural elucidation expected)

MODULE IV: ORGANO METALLIC COMPOUNDS 9hours

Organo metallic compounds, Definition and classification

Grignard Reagent, preparation and synthetic applications

Ziesels salt-Bonding and Structure, preparation and use

Biological and environmental aspects of organo metallics

Organo metallics in medicine, organo mercury, boron and silicon compounds

Metal carbonyls:Iron and Nickel carbonyls, preparation- Applications - Monds Process

MODULE V: BIO INORGANIC COMPOUNDS 9 hours

Metalloporphyrins - cytochromes - chlorophyll photosynthesis and respiration -

Haemoglobin and myoglobin, mechanism of O_2 - CO_2 transportation

Nitrogen fixation, carbon fixation and carbon cycle

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

MODULE VI: SPECTROSCOPY II 9 hours

Raman spectroscopy, stokes and antistokes lines, quantum theory of Raman spectrum, advantages and disadvantages of Raman spectrum, complementary with IR spectrum, mutual exclusion principle

NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external

magnetic field, chemical shift, spin-spin coupling in ethyl bromide and ethanol, applications,

Nuclear Resonance Imaging, ESR spectroscopy introduction and applications

REFERENCES

1. I. L. Finar, Organic Chemistry, Vol. I &II, Longman
2. Jerry March : Advanced Organic Chemistry
3. Avinash Upadhyay.Kakoli Upadhyay.Nirmalendu Nath : Bio Physical Chemistry Principles and techniques
4. B K Sharma: Spectroscopy
5. Y R Sharma: Spectroscopy
6. J.E.Huheey, Inorganic Chemistry, Pearson.

IV Semester B.Sc Degree Examination Model question paper
Complementary course for Bio-Chemistry Majors

Course Code CH1431.6 Credit 3 ORGANIC CHEMISTRY AND SPECTROSCOPY (2020 admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. What is rate determining step?

2. Define Racemic mixture.

3. Represent the configurations of D and L glyceraldehyde.

4. Write an example for volatile oil .

5. What is Zieses' salt?

6. Define Iodine value.

7. Write an example for volatile oil .

8. Give the formula of iron and nickel carbonyls.

9. What is esr spectroscopy?

10. The metal part in cytochrome.

SECTION B

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

11. How benzene is nitrated? Give chemical equation.

12. What is steric effect?

13. Discuss the importance of Morphine.

14. Which of the following are optically active ? Why?

2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane

15. Give two differences between enantiomers and diastereoisomers.

16. What is Mond's process?

17. How are alkaloids extracted from natural sources?

18. Write any two organosilicon compounds used in medicine.

19. State mutual exclusion principle.

20. Which compound is used as standard in nmr spectroscopy? Why?

21. What is carbon cycle?

22. Explain saponification value and acid value.

SECTION C

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

23. Discuss the optical isomerism of tartaric acid?

24. Illustrate the directive influence of -NO_2 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 inO_2-CO_2 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)

Explain chemical shift (4 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
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

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

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

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

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

d. Estimation of a strong acids using standardized NaOH

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

B. Permanganometry

a. Standardization of KMnO4 by oxalic acid/sodium oxalate and Mohr's salt

b. Estimation of oxalic acid/sodium oxalate

c. Estimation of Mohr's salt

d. Estimation of calcium

C. Dichrometry

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