UNIVERSITY OF KERALA

First Degree Programme in Chemistry

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

CHEMISTRY COMPLEMENTARY COURSES

SCHEME AND SYLLABI

2017 ADMISSION ONWARDS

General Instructions to Complementary courses

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

B Sc Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

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

- Course code of physics majors is used as an example

GENERAL ASPECTS OF EVALUATION

CONTINUOUS EVALUATION FOR LECTURE COURSES

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

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

(ii) Assignment /seminar and

(iii) Test

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

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

QUESTION PAPER PATTERN FOR CONTINIOUS EVALUATION TEST

1. The theory examination has a duration of 1.5 hours
2. Each question paper has three parts: A, B , C
3. Part A contains ten questions. Each question carries1mark. The questions may be in the forms – one word/one sentence.
4. Part B contains twelve questions. Out of these twelve questions, the students have to answer 7 questions. Each question carries 2 marks. Each answer should contain four points. (Short Answer type).
5. Part C contains nine questions of which the candidate has to answer 4 questions. Each question carries 4 marks. The answer must contain 8 points (Short Essay type). Question paper should contain 20% hard, 60% medium and 20% easy questions

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

CONTINUOUS EVALUATION FOR LABORATORY COURSES

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

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

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I. 2. 1. EVALUATION OF THE RECORD

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

CE for Laboratory Record		
No	Sub Component	Marks

1	Punctual submission and Neat presentation	All four sub-components present & satisfactory 5 Only three : 4 Only two : 3 Only one : 2
2	Record of more than 90% experiments in the syllabus	
3	Calculations and absence of errors/mistakes	
4	Accuracy of the result	

During ESE external examiner has to verify the Lab report of experiments certified by the tutor and HOD. The scheme of examination for lab exams may be framed by the Board of examiners.

END SEMESTER QUESTION PAPER PATTERN & GUIDELINE FOR QUESTION PAPER SETTERS

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

QuestionPaperPatternforTest		
QuestionNo	*TypeofQuestion*	*Marks*
Part A: 1-10	10 one word/one sentence	1x10=10
Part B: 11-22	8 out of 12; Short Answer	2x8=16
Part C: 23-31	6 out of 9; Short Essay	4x6=24
Part D: 32-35	2 out of 4; Essay	2x15=30
		Total = 80-80 marks

SYLLABUS OF COMPLEMENTARY COURSE

(For students of Physics Majors)

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

I B.Sc Complementary

THEORETICAL CHEMISTRY

(For students of Physics majors)

(Common for Physics and Geology students)

SEMESTER I Complementary Course N o. – 1 Course Code- CH1131 .1 Credit-2

Total Hour : 36 L–T-P- 2-0-2

Module I –Atomic Structure 9hrs

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module II - Chemical bonding 9hrs.

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

Polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.

Hybridisation and structure of molecules – SP, SP^2, SP^3, dSP^2, dSP^3, SP^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
9hrs.

Radio active equilibrium (qualitative idea only) detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry – Units – rad, gray and roentgen. Fricke dosimeter and ceric sulphate dosimeter. Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module IV: Analytical principles9 Hrs

Analytical methods in Chemistry – principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis, common ion effect- solubility product- precipitation of cations- chromatography- principle and applications of paper and thin layer chromatography.

References

1. Atomic structure and chemical bonding withintroduction to molecular spectroscopy- Manas Chandra.
2. Inorganic chemistry- Puri, Sharma and Kalia
3. Fundamental concepts of inorganic chemistry- E S Gilreath
4. Inorganic chemistry-Madan
5. Basic inorganic chemistry-F A Cotton, G Wilkinson and P L Guas
6. Elements of nuclear chemistry- Arnicker
7. Text book of qualitative analysis- A I Vogel
8. Text book of quantitative inorganic analysis- A I Vogel

9. Quantitative analysis: Laboratory manual- Day and Underwood

First semester B.Sc Degree Examination Model question paper

Complimentary course for PhysicsCH1131.1: THEORETICALCHEMISTRY

(2017 admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?
6. Emission of ------ from a radioactive element does not bring any change in charge or mass.
7. What is the base of radiocarbon dating.
8. What is the result of the beta emission of group 15 element?
9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.
10. Calculate the normality of 10% NaOH solution.

SECTION B

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

11. State Hund's rule.
12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?
13. Write the Schrodinger wave equation and explain the terms?
14. NH_3 and CH_4 have SP^3 hybridization. Shapes of these molecules are different. Why?
15. Distinguish between intermolecular and intramolecular hydrogen bonding?
16. The bond energy of NO^+ is larger than that of NO. Why?
17. Define Soddy's group displacement law?
18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?

19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?
20. Phenolphthalein is not suitable for the titration of strong acid X weak base. Why?
21. How would you prepare 100ml of 0.05M Mohr's slat solution?
22. What are primary standards? Give two examples. SECTION C

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

23. Why is Bohr model of atom considered inadequate?
24. Explain hydrogen spectrum?
25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?
26. Explain the shape of SF_6 molecule.
27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.
28. Explain neutron activation analysis and its application?
29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.
30. Explain the principle and application of paper chromatography?
31. Explain the theory of redox indicators.

SECTION D

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

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

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

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

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

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

(iii) Describe the different approaches of electronegativity?

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

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

    What is the half life of the decay?

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

35. (i) what are acid base indicators?

    (ii) explain the use of indicators in acid base titrations.

    (iii) Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

SYLLABUS OF COMPLEMENTARY COURSE
(For students of Physics majors)
(Common for Physics and Geology students)

Physical chemistry-I

SEMESTER II Complementary Course No.- 2 Course Code-CH1231 .1Credit – 2

Total Hours - 36 L-T-P 2-0-2

ModuleI –Thermodynamics 9hrs

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies, significance of Δ G, Δ H and available work – criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

Module II Thermochemistry:9hrs

Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

Module III –Chemical Equilibrium 9 hrs

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

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ Le Chatelier's principle and the discussion of the above reactions on its basis.

Module IV–Ionic Equilibrium9hrs

Concepts of Acids and Bases, ionization of weak electrolytes. Influence of solvent on acid strength – leveling effect - pH and its determination of potentiometric method. Buffer solutions and calculations of their pH. Henderson equation. Hydrolysis of salt – degree of

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

References

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

Second semester B.Sc Degree Examination Model question paper

Complimentary course for Physics Majors

Semester II Complementary Course No.- 2 Course Code-CH1231 .1Credit – 2

PHYSICAL CHEMISTRY- I

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

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

SECTION B

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

11. One mole of an ideal gas at 25oc is allowed to expand isothermally and reversibly form a volume of 10 liters to 20 liters. Calculate the work done by the gas?
12. State the first law of thermodynamics. What are its limitations?
13. Write the relation between ΔG, ΔH and ΔS. What is the condition for spontaneity of a process?

14. Calculate the enthalpy of hydrogenation, C_2H_4 (g) + H_2(g) ___ C_2H_6 (g).Given that bond energy of H-H= 433kJ, C=C =615kJ and C-C= 347kJ and C-H = 413kJ.
15. Define Enthalpy of formation.
16. What is bond dissociation energy?
17. State Le Chatlier principle.
18. What is isochoric process?
19. What are the characteristics of equilibrium constant?
20. Define Lewis acid and base.
21. What is meant by levelling effect?
22. What is ionic product of water?

SECTION C

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

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?
26. State and explain Hesse's law.
27. Derive relation between heat of reaction at constant volume and constant pressure.
28. Calculate the equilibrium constant for a reaction at 25^0C. ΔG^0=20kcal.
29. Predict the effect of pressure on the dissociation of PCl_5.
30. What is meant by Buffer solution? Give an example of acidic and basic buffer solution? Explain its mechanism?
31. Write Henderson equation. What is its significance? SECTION D

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

32. (i) Derive an expression for work done in the reversible isothermal isothermal expansion of an ideal gas. (ii) Define
    (a) Work function
    (b) Gibbs free energy function
    (c) Entropy
    (d) Internal energy
33. (i) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.

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

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

    (ii) Derive relation between Kp and Kc.

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

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

    (ii) Write a note on salt hydrolysis?

SYLLABUS OF COMPLEMENTARY COUSRSE (For students of Physics Majors)

PHYSICAL CHEMISTRY- II

SEMESTER III Course-3 Credit-3Course Code – CH1331.1

L-T-P 3-0-2 54 Hrs

Module 1: Gaseous State 9hrs

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

Module II – Crystalline State 9hrs

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc of cubic crystals – Representation of lattice planes of simple cubic crystal - Density from cubic lattice dimension – calculation of Avogadro number - Bragg equation, diffraction of Xrays by crystals – single crystal and powder method. Detailed study of structures of 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 – H2 – O2 and hydrocarbon – O2 type.

Module IV – Catalysis and Photo Chemistry 9hrs

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

Photo Chemistry:- Laws of Photo Chemistry, Grothus – Drapter law, Beer Lambert's law, Einstein's laws, quantum yield, H2 – Cl2 reaction, H2 – Br2 reaction – Fluorescence and phosphorescence, chemiluminescence and photo sensitization.

Module – V: Chemical Kinetics 9 Hrs

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

Module VI-Group theory 9 Hrs

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

References

1. Principles of physical chemistry-Puri, Sharma and Pathania
2. Advanced physical chemistry-Gurudeep Raj
3. Physical chemistry- PW Atkins
4. Physical chemistry-F Daniel and R A Alberty
5. Physical chemistry-E A Moelwyn
6. Introduction to solids- L V Azaroff
7. Solid state chemistry- N B Hannay
8. Group theory in chemistry-V Ramakrishnan and M S Gopinathan
9. Group theory and its applications in chemistry- A Salahuddin kunju and G krishnan

Third Semester B.Sc Degree Examination Model Question Paper

Complimentary course for Physics

CH1331 .1: PHYSICAL CHEMISTRY- II

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1.What is the ratio of observed molar volume to ideal molar volume is?

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

SECTION B

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

11. Define critical temperature and explain its significance?
12. What is virial equation of states?
13. Explain the term Space lattice and Unit cell.
14. Both NaCl and KCl have fcc structures but KCl behaves towards X-rays like simple cubic lattice. Why?
15. What is liquid junction potential? How can it be eliminated?
16. What are reference electrodes? Give their significance?
17. State Einstein's law of photochemical equivalence?
18. What is meant by chemiluminescence?
19. What is meant by autocatalysis?
20. Define order and molecularity of a reaction?

21. A substance decomposes following first order kinetics. The half life period of a reaction is 35 minutes. What is the rate constant of the reaction?

22. What is meant by point group?

SECTION C

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

23. What is the law of corresponding states? How is it derived from the vander waal's equation?

24. Calculate the constants a and b, if Tc=31^{0}C, Pc=72.8atm and R=0.082lit atm/K?

25. What are the Miller indices? How are they determined?

26. EMF of a standard Daniel Cell is 1.01832 V at 298K. Temperature coefficient of the cell is 5x10^{-5}V/K. Calculate ΔG, ΔH, and ΔS of the cell reaction?

27. Write a brief note on Calomel electrode?

28. State and explain Beer-Lambert's law? What are its limitations?

29. Explain pseudo order reactions with suitable examples?

30. Give the group multiplication table for C_{2V}

31. Explain the different symmetry elements?

SECTION D

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

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

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

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

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

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

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

34. (i) Write a brief note on fuel cells? (ii) State and explain Nernst equation (iii) Explain the principle of potentiometric titrations?

35. (i) What is catalysis? What are the general characteristics of catalyst? (ii) Derive an expression for rate constant of a first order reaction? (iii) Explain the influence of temperature on reaction rates?

SYLLABUS OF COMPLEMENTARY COUSRSE

(For students of Physics Majors)

Spectroscopy and Material Chemistry

SEMESTER IV Course-4 Credit-3 Course Code – CH1431 .1

L-T-P 3-0-2 Total 54hrs

Module I - Spectroscopy-I 9hrs

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

selection rule, frequency separation, calculations of force constant, Electronic spectroscopy –types of transition and regions where they absorb.

Module II- SPECTROSCOPY- II 9 hrs

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

coupling – fine structure spectrum, application to simple molecule

Module III Coordination Chemistry 9 Hrs

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis. 9 hrs

Module IV – Metallurgy 9 Hrs

General principles of occurrence and extraction of metals – purification, roasting, calcination and smelting, reduction to metal, different method with examples, refining of metals- electrolytic and zone refining. Van – Arkel method. Metallurgy of titanium, cobalt, nickel, thorium and uranium.

Module V :Chemistry of Nano Materials 9hrs

Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc.

Nanosystems in nature.

Preparation of Nano particles – Top – down approach and bottom – top approach, sol – gel synthesis, colloidal precipitations, Co- precipitation, combustion technique. Properties of nano particles: optical, magnetic and mechanical properties.

Tools for measuring nano structure – XRD, Atomic force Microscopy (AFM), Scanning Tunneling

Microscopy (STM), and Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM). Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, Medical applications (use Au, Ag,ZnO and ZnO2 as examples)

Module VI- Advanced Materials 9hrs

Magnetic materials-classification-applications- conducting polymers- polyacetylene-ployanilines- synthesis- applications- photoconducting polymers-examples-super conducting materials - Liquid crystals – mesomorphic state, types of liquid crystals applications and examples. .

References

1. Fundamental of molecular spectroscopy- C N Banwell
2. Atomic structure and chemical bonding in molecular spectroscopy- Manas Chandra
3. Physical chemistry-R Stephen Berry, Sturt A Rice and John Rose
4. Inorganic chemistry-J E HuheeCoordination chemistry- Bosolo and Johnson
5. Coordination chemistry- S F A Kettle
6. Inorganic chemistry- Puri, Sharma and Kalia
7. NANO: the essentials –T Pradeep
8. Introduction to Solid State Physics- Charles Kittel

Fourth semester B.Sc Degree Examination Model question paper

Complimentary course for Physics

CH1431 .1: Spectroscopy and Material Chemistry
(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Which of the following give pure rotational spectrum: H_2, N_2, CO_2, HCl?
2. What is Rayleigh scattering?
3. What is the selection rule for vibrational transition?
4. What is the condition for a molecule to be NMR active?
5. What is Wilkinson's catalyst?
6. What is nano shells?
7. Write an example for a chelate.
8. What are the ores of titanium?
9. Name the nano meterials used in semiconductors?
10. What are ferromagnetic materials?

SECTION B

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

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

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

23.Why are anti-stokes lines intense than the stokes lines in the Raman spectrum?

24. Taking the example of HCl show how rotation of the molecule causes dipole moment fluctuations?
25. State and illustrate the Frank-Condon principle.

26. Define the terms: Bathochromic shift, Hypsochromic shift, hyperchromic shift, hypochromic shift.
27. Discuss Werner's theory of coordination compounds.
28. Explain the formation of low spin and high spin complexes with the help of crystal field theory.
29. Outline the principles involving electrolytic refining.
30. Explain the properties of nano particles.
31. Give a short note on superconducting materials. SECTION D

(Answer any twot questions. Each question carries 15 mark)

32. (i) Derive an expression for allowed energies of rotational levels ina diatomic molecule.
    (ii) Show that for a rigid diatomic rotor the moment of inertia is given by $I = \mu r^2$.
    (iii) Discuss the quantum theory of Raman spectroscopy 33.(i) Explain the underlying principle in an NMR spectrum.
    (ii)What are the different kinds of protons indicated in an NMR spectrum. How do they produce their characteristics signals?
    (iii)How can the NMR method be used to distinguish between the structures of 1propanol and 2-propanol?
34. (i) Give an account of crystal field theory?
    (ii) What are applications of coordination compounds in qualitative analysis? (iii) Give an account of hydrometallurgy.
35. (i) Explain the applications of nanomaterials in electronic and robotics.
    (ii) Explain working principle of SEM and TEM.
    (iii)Give a note on types of liquid crystals.

SYLLABUS FOR LABORATORY COURSES FOR B.Sc COMPLEMENTARY CHEMISTRYCourse V
Course CodeCH1432 .1 Credit 2 For Physics & Geology MajorsSemesters 1, 2, 3 & 4

Reactions and identification of cations : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} and NH_4^{+}

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

Volumetric analysis- one burette method only

A. Acidimetry and Alkalimetry

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

b. (Estimation of a strong base and a weak base using standardized HCl)
Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

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

[d. Preparation and standardization of decinormal NaOH using oxalic acid as primary standard.]

(e. Estimation of a strong acid using standardized NaOH))

B. Permanganometry

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

b. Estimation of oxalic acid / sodium oxalate.

c. Estimation of Mohr's Salt. d. Estimation of calcium.

C. Dichrometry

e. Preparation of Std. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

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

D. Iodometry and Iodimetry

g. Standardization of sodium thiosulphate using std. potassium dichromate. h. Estimation of copper in a solution

i. Estimation of iodine

E. Complexometric titrations

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

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

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

Physical Chemistry Experiments

1. Conductometric titrations- HCl Vs NaOH

2. Potentiometric titrations- Ferrous iron Vs Dichromate

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

SYLLABUS OF COMPLEMENTARY COURSE
(For students of Geology Majors)
(Common for Physics and Geology
students)I B.Sc Complementary
THEORETICAL CHEMISTRY
SEMESTER I Complementary Course – 1 Course Code- CH1131 .2 Credit-2

Total Hour : 36 L–T-P- 2-0-2

Module I –Atomic Structure 9hrs

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module II - Chemical bonding 9hrs.

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

Polarity of covalent bond its relation with electronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity , dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility.

Hybridisation and structure of molecules – SP, SP^2, SP^3, dSP^2, dSP^3, SP^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
9hrs.

Radio active equilibrium (qualitative idea only) detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry – Units – rad, gray and roentgen. Fricke dosimeter and ceric sulphate dosimeter. Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module IV: Analytical principles9 Hrs

Analytical methods in Chemistry – principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators.

Inorganic qualitative analysis, common ion effect- solubility product- precipitation of cations- chromatography- principle and applications of paper and thin layer chromatography.

References

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

First semester B.Sc Degree Examination Model question paper

Complimentary course for Geology CH1131.2: THEORETICALCHEMISTRY

(2017 admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. Write the electronic configuration of Chromium?
2. Name the principle according to which an orbital can accommodate only two electrons?
3. What is the shape of IF_7 molecule?
4. Write the hybridization of Boron in BF_3?
5. What is the bond order of O_2^+ ?
6. Emission of ------ from a radioactive element does not bring any change in charge or mass.
7. What is the base of radiocarbon dating.
8. What is the result of the beta emission of group 15 element?
9. A useful indicator for the titration of acetic acid versus sodium hydroxide is --------.

10. Calculate the normality of 10% NaOH solution. SECTION B

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

11. State Hund's rule.
12. Give the general equation for the frequency of the lines in the Balmer series for hydrogen?
13. Write the Schrodinger wave equation and explain the terms?
14. NH_3 and CH_4 have SP^3 hybridization. Shapes of these molecules are different. Why?
15. Distinguish between intermolecular and intramolecular hydrogen bonding?
16. The bond energy of NO^+ is larger than that of NO. Why?
17. Define Soddy's group displacement law?
18. The half life period of Ra^{226} is 1620 years. Calculate the value of K for its decomposition in $years^{-1}$?
19. What are beta rays? Which element is formed when beta particle is emitted from Cl-38?
20. Phenolphthalein is not suitable for the titration of strong acid X weak base. Why?
21. How would you prepare 100ml of 0.05M Mohr's slat solution?
22. What are primary standards? Give two examples. SECTION C

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

23. Why is Bohr model of atom considered inadequate?
24. Explain hydrogen spectrum?
25. Explain why CO_2 and CCl_4 molecules are non polar but $CHCl_3$ molecule is polar?
26. Explain the shape of SF_6 molecule.
27. Water exists as liquid at room temperature while H_2S is a gas at the same temperature. Account for the reason.
28. Explain neutron activation analysis and its application?
29. Write a note on (i) Geiger-Muller counter and (ii) Wilson cloud Chamber.
30. Explain the principle and application of paper chromatography?
31. Explain the theory of redox indicators.

SECTION D

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

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

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

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

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

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

(iii) Describe the different approaches of electronegativity?

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

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

What is the half life of the decay?

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

35.(i) what are acid base indicators?

(ii) explain the use of indicators in acid base titrations.

(iii)Discuss the titration curves for the titration of strong acid – strong base and weak acid –strong base?

SYLLABUS OF COMPLEMENTARY COURSE
(For students of Geology majors)
(Common for Physics and Geology students)
Physical chemistry-I

SEMESTER II Complementary Course No.- 2 Course Code-CH1231 .2Credit – 2

Total Hours - 36 L-T-P 2-0-2

ModuleI –Thermodynamics 9hrs

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies,significance of Δ G, Δ H and available work – criteria of equilibrium, and spontaneity on the basis of entropy and free energy – Gibbs-Helmholtz equation.

Module II Thermochemistry 9hrs

Enthalpies of formation, combustion, neutralization, solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

Module III –Chemical Equilibrium 9 hrs

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

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ Le Chatelier's principle and the discussion of the above reactions on its basis.

ModuleIV–Ionic Equilibrium 9hrs

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

References

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

B.Sc Degree Examination Model question paper

Complimentary course for Geology Majors

Semester II CH1231.2: PHYSICAL CHEMISTRY- I

(2017 Admission onwards)

Time: Three Hours Maximum Marks: 80

SECTION A

(Answer all questions. Each question carries 1 mark)

1. What is a reversible process?
2. Write the first law of thermodynamics.
3. What is an isochoric process?
4. What is standard enthalpy of formation?
5. Write one example for an exothermic reaction.
6. What is enthalpy of hydration?
7. What is rate constant?

8. What is the significance of ΔG?
9. What is common ion effect?
10. What is the P^H of 0.01M HCl?

SECTION B

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

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

SECTION C

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

23. What do you understand by heat capacity of a system? Show from thermodynamic considerations that Cp - Cv = R.
24. Derive Gibb's Helmohtz equation.
25. In a certain process 675 J of heat is absorbed by a system while 290 J of work is done on the system. What is the change in internal energy for the system?
26. State and explain Hesse's law.
27. Derive relation between heat of reaction at constant volume and constant pressure.
28. Calculate the equilibrium constant for a reaction at 25^0C. ΔG^0=20kcal.
29. Predict the effect of pressure on the dissociation of PCl_5.

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

31. Write Henderson equation. What is its significance? SECTION D

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

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

    (ii) Define

    (a) Work function

    (b) Gibbs free energy function

    (c) Entropy

    (d) Internal energy

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

    (ii) Calculate the heat of formation of CO_2. Given that CO (g)+H_2O (l) $\Longleftrightarrow$ 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 ^{0} C to 35^{0}C. Calculate ΔH^0 of the reaction?

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

    (ii) Write a note on salt hydrolysis?

Complementary Chemistry

(For Geology Majors)

Physical , Analytical and Inorganic ChemistrySemester III Course-3
Credit-3Course Code – CH1331 .2

L-T-P 3-0-2 Total 54 hrs

Module I – Gascous State

Maxwell's distribution of molecular velocities (no derivation), average, most probable and RMS velocities collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of Vander Waal's constants and critical constants, law of corresponding states – reduced equation of state, Joule Thomson coefficient, liquefaction of gases –Linde's and Claudes process. 9 Hrs

Module II – Crystalline State

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems – Miller indices, Bravais lattices, primitive, bcc and fcc lattices of cubic crystals – Bragg equation - diffraction of X rays by crystals – single crystal and powder method. Detailed study of structure of NaCl and KCl crystals. Liquid crystals – mesomorphic state, types of liquidcrystals, application and examples. 9 hrs

Module III – Chemical Cycles and Group Properties

Carbon, Sulphur, Nitrogen, phosphorous and hydrologic cycle.

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

Classification of oxides – Acidic, Basic, Amphoteric and neutral 9 hrs

Module IV: Surface Chemistry and Colloids (9 Hrs)

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

Colloids:True solution, colloidal solution and suspension. Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples. Purification of colloids by electrodialysis and ultrafiltration. Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis. Origin of charge and stability of colloids – Coagulation - Hardy Schulze rule – Protective colloids - Gold number. Emulsions. Applications of colloids: Application of colloids Cottrell precipitator – purification of water, coagulation, reverse osmosis, electro dialysis, delta formation, medicines, cleaning action of detergents and soaps.

Module V Inorganic Polymers9hrs

General properties of inorganic polymer, phosphazenes – preparation of linear and cyclo phosphazene with examples, properties, and application, silicones – General methods of preparation and properties examples. Application of Silicones, Silicone rubber, silicone resins. 9 hrs

Module VI Soil and Water Chemistry 9 hrs

Soil – Composition, mineral matter in soil process of soil formation, weathering –

physical (mention), chemical (detail) + biological (mention)

Saline and alkaline soil (brief explanation) Rocks – different types (Igneous, sedimentary and Meta morphic.) Analysis of lime stone qualitative treatment only.

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

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

References

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

Model Question Paper Chemistry (complementary) for Geology majors (2017 admission onwards)

Semester III Course Code: CH1331 .2 Course – III

Physical, Analytical and Inorganic Chemistry

Time: Three Hours Maximum marks: 80

Section A. Answer all questions. Mark 1.

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

Section B. Answer any eight questions. Each question carries 2 marks.

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

Section C. Answer any six questions. Each question carries 4 marks.

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

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

31. (a) Explain liquid crystals with examples for each type (b) Give a detailed account on the structure of NaCl.

32. Write a note on (a) Nitrogen cycle (b) different types of rocks and (c) main quality characteristics of water.
33. Give an account of the preparation, properties and important applications of (a) silicates (b) phosphazenes.
34. (a) Write a note on different types of adsorption of gases by solids.
    (b) Describe the applications of colloids.
35. (a) Write a short note on the various purification methods of water.
    (b) Calculate the average velocity and root mean square velocityof a molecule in a sample of oxygen at 0 °C?

Semester IV – Geology Majors

Physical and Analytical Chemistry -II Course-4

Credit -3Course Code – CH1431 .2

L-T-P 3-0-2 Total 54 Hrs

Module I Metallurgy

Metallurgy of Titanium, Iron, cobalt, Nickel, Thorium, Uranium. Extraction of lanthanides. 9 Hrs

Module II Petro Chemicals

Introduction to crude oil, exploratory methods, constitution of crude oil, natural gas - constituents. Distillation of crude oil, separation of natural gas and different fractions. Meaning of terms such as ignition point, flash point, octane number. Types of hydrocarbon fuels and their characteristics. Cracking – catalytic cracking, hydro cracking, isomerisation, reforming, sulphur, hydrogen, petroleum, coke and nitrogen compounds from petroleum. 9Hrs

Module III Chemical Kinetics

Rates of reactions, various factors influencing rates of reactions – order and molecularity - Zero, first, second and third order reactions – derivation of integrated rate equation, fractional life time – units of rate constants, influence of temperature on reaction rates – Arrhenius equation, calculation of Arrhenices parameters – Collision theory of rates. 9 hrs

Module IV Catalysis and Photo Chemistry 9hrs

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

Photo Chemistry:Laws of photo Chemistry .Grotthus Draper Law, Einstein's law, Beer lambert law, Photo Chemical equivalence and quantum yield, explanation for high and low quantum yields, H2-Cl2 reaction, H2-Br2 reaction, Photosensitisation and Chemiluminescence.

Module V - Electro Chemistry 9hrs

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

EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, Fuel cells – H2 – O2 and hydrocarbon – O2 type.

ModuleVI Instrumental Methods of Analysis9 hrs

Spectral methods – Atomic Absorption Spectroscopy (AAS) principle, measurement, advantages, disadvantages, and applications. Flame Emission Spectroscopy (FES) principle, measurement,(single beam method) applications.

Thermal methods: Thermo gravimetric analysis (TG) principle and method, Factors affecting thermogravimetric analysis, Application, Differential Thermal Analysis (DTA) principle, method, factors affecting DTA Applications.

References

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

6. Physical Chemistry- N.M.Kapoor

7. Soil and Noise pollution- B.K.Sharma

8.IndustrialChemistry–B.K.Sharma.

Model Question Paper Chemistry (complementary) for Geology majors (2017 admission onwards)

Semester IV Course Code: CH1431.2 Course IV

Physical and Analytical Chemistry II

Time: Three Hours Maximum marks: 80

Section A. Answer all questions. Mark 1.

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

Section B. Answer any eight questions. Each question carries 2 marks.

11. What is the influence of temperature on reaction rate?
12. A substance decomposes following first order kinetics. The half life period of the reaction is 35 minutes. What is its rate constant?
13. State Einstein's law of photochemical equivalence.
14. Define quantum yield of a photochemical reaction.
15. Explain van't Hoff reaction isotherm.
16. Illustrate SHE.
17. Write the principle of AAS.
18. How do you differentiate a TG curve from a DTA curve?
19. What is smelting.
20. Distinguish between order and molecularity?
21. What is Grotthus- Draper law?
22. Explain chemiluminescence.

Section C. Answer any six questions. Each question carries 4 marks.

23. Give the Arrhenius equation. How will you determine the Arrhenius parameters?
24. Explain photosensitization reaction with an example.
25. Explain the method used to determine transport number of an electrolite.
26. What is the principle of flame emission spectroscopy? Mention its important applications.
27. What are the general methods for refining of metals?

28. Give an account of different types of hydrocarbon fuels and their characteristics.
29. Distinguish between isotherm and isochore.
30. Explain quantum yield in terms of H_2-Cl_2 reaction.

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

31. (a) Derive the expression for the rate constant of a first order reaction. (b) How will you express the units of rate constant for reactions of order 1, 2 and 3?
32. Write a note on (a) Extraction of lanthanides (b) Types of hydrocarbon fuels and their characteristics (c) Photosensitisation.

33. Give a detailed account on the principle and applications of (a) TG and (b) DTA.
34. (a) Discuss the principle, measurement and applications of Flame Emission Spectroscopy (FES)
    (b) Explain Collision theory of rates.
35. (a)Explain the method used to determine transport number of an electrolyte.
    (b) A solution of silver nitrate containing 12.14 g of silver in 50 ml of solution was electrolysed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, while 1.25 g of metallic silver was deposited on the cathode. Calculate the transport number of Ag+ and – NO3 ions.

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course CodeCH1432 .2 Credit 2 For Physics & Geology Majors

Semesters 1, 2, 3 & 4

Reactions and identification of cations : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} and NH_4^{+}

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

Volumetric analysis

A. Acidimetry and Alkalimetry

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

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

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

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

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

e. Estimation of a strong acid using standardized NaOH.

B. Permanganometry

a. Standardisation of KMnO4 by oxalic acid sodium oxalate and Mohr's salt b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium

C. Dichrometry

e. Preparation of Std. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

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

D. Iodometry and Iodimetry

g. Standardization of sodium thiosulphate using std. potassium dichromate. h. Estimation of copper in a solution

i. Estimation of iodine

E. Complexometric titrations

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

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

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

Gravimetric Analysis

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

2. Estimation of barium chloride solution.

Physical Chemistry Experiments

1. Conductometric titrations- HCl Vs NaOH

2. Potentiometric titrations- Ferrous iron Vs Dichromate

This laboratory based course reinforces the qualitative and quantitative chemical analysis that

the student has learned in the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} semesters

Complementary Chemistry offered to Botany Majors

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

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

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

SYLLABUS FOR COMPLEMENTARY COURSE COURSE

Theoretical Chemistry (Common for Botany/Zoology/Microbiology)

(For Students of Botany Majors)

SEMESTER 1 Complementary Course 1 Course Code-CH1131 .3 Credit-2

L-T-P 2-0-2 36 Hours

Module I – Atomic Structure (9 hrs)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.

Module II – Chemical Bonding (9 hrs)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+

Module III – Analytical Principles (9 hrs)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Beer- Lambert law- Principles of colorimetry – Estimation of Iron and phosphate.

Module IV – Environmental Chemistry (9 hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion.. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.-Dissolved oxygen-BOD,COD

References

1. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
2. Concise Inorganic Chemistry – J.D. Lee
3. Environmental Chemistry A. K. De

4. Modern Inorganic Chemistry A.D. Madan
5. A. I. Vogel, “Text book of Qualitative Analysis”
6. A. I. Vogel, “Text book of Quantitative Inorganic Analysis”.
7. S. K. Banerji, “Environmental Chemistry”.
8. A. K. De “Environmental Chemistry - An introduction”
9. B. K. Sharma “Air Pollution”.
10. V. K. Ahluwalia “Environmental Chemistry”
11. G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”

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Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER I Complementary CourseBotany majors. Course Code -CH1131 .3 THEORETICAL CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

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

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

Section-B

Short answer type. Answer any 8 questions. Each question carries two marks

11. What is Bohr Bury’s rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr’s theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?
16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?

18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?
20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

Short essay. Answer any 6 questions from the following. Each question carries four marks.

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

Section-D

Essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
    (c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.
    (b) Explain the theory of redox indicators.
    (c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.
34. (a) Write a note on Hydrogen bonding and its consequences.
    (b) How electronic configuration of molecules related to molecular behavior? Explain.
    (c) Explain Fajan's Rule.
35. (a) Discuss the formation and importance of ozone layer.
    (b) What is meant by pollution and pollutants? Explain the classification of air pollutants. (c) What are the sources of important air pollutants.

Complementary Chemistry for BOTANY Majors
SEMESTER II Course code-CH1231 .3 Credit-2
Inorganic and bioinorganic chemistry(Common for Botany/Zoology/Microbiology)
L-T-P 2-0-2 (36 hrs)

Module I :Organometallics (9 hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

Module II Nuclear Chemistry (9 hrs)

Natural radioactivity, modes of decay, Geiger–Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

Module III - Coordination Chemistry (9 hrs)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties of transition metal complexes. Application of metal complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hrs)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of O2 – CO2 transportation, nitrogen fixation, carbon fixation and carbon cycle. Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems.

References

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

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Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER II Complementary CourseBotany majors. Course Code CH1231.3
INORGANIC AND BIOINORGANIC CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

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

1. Give the structure of Zeise's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

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

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. What are trace elements?

22.What is the role of chlorophil in photosynthesis?

Section-C

Short essay. Answer any 6 questions from the following. Each question carries four marks.

23.Write a note on organotin compounds.
24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.
25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?
26.Explain the relation between nuclear stability and n/p ratio.
27.Write the biological effects of radiation.
28.Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.
29.Explain the magnetic properties of octahedral complexes with suitable examples.
30.Discuss briefly the biochemistry of iron toxicity and nutrition.
31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)
(b) What are Frankland reagents? Give its significance. (5 marks)
(c) Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)
(b) Give the principle of neutron activation analysis. (5 marks)
(c) Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)
(b) Explain the applications of complexes in qualitative analysis. (5 marks) (c) Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)
(b) Explain nitrogen Fixation. (5 marks)
(c) Write a short note on hemoglobin. (5 marks)

SYLLABUS OF COMPLEMENTARY COURSE

Physical Chemistry

(For Students of Botany Majors)

SEMESTER III Course-3 Credit-3 Course Code – CH1331 .3

L-T-P 3-0-2 Total: 54 Hours

Module I. Chemical kinetics 9 Hrs

Chemical kinetics, catalysis, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions (derivation of first order only) fractional life time, units of rate constants, influence of temperature on reaction rates, Arrehinius equation, Calculation of Arrhenius parameters, Collision theory, catalysis, different types of catalysis, intermediate compound formation theory and adsorption theory.

Module II -Ionic equilibrium 9 Hrs

Arrhenius, Lowry- Bronstead and lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, He nde rson e quati on, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant .

Module III. Solutions 9 Hrs

Completely miscible liquid pairs, vapour pressure - composition curve, boiling point-composition curve- ideal and non ideal solutions, fractional distillations, azeotropes. Partially miscible liquids - CST, phenol- water, nicotine-water system, Effect of impurities on miscibility and CST, immiscible liquid pairs, steam distillation- Distribution law and its limitations, applications of solvent extractions.

Module IV UV and NMR spectroscopy 9Hrs

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation, concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects. UV-Visible spectra of enes. Calculation of λmax. Applications of UV spectroscopy - conjugation, functional group and geometrical isomerism. Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI .

Module V Dilute solutions: 9hrs

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

Module VI colloids- 9hrs

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation.

References

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

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Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER III Complementary Course. Course Code CH1331 .3
(For Students of Botany Majors)

PHYSICAL CHEMISTRY

Time:3hours Maximum Marks : 80

SECTION – A

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

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define pH.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift.
7. Explain chromophore with an example.

8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Define Van't Hoff factor.

SECTION - B

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

11. What are the factors which affect the rate of a chemical reaction?
12. Write down the expression that gives the dependence of the rate constantof a chemical reaction on the absolute temperature and explain the terms involved. 13.Explain briefly Lewis concept of acids and bases with two examples
14. What is zeta potential? How does it arise?
15. What is critical micelle concentration? Discuss the structure of micelles in polar and nonpolar media
16. Tetra Methy Silane (TMS) is chosen as a reference compound in NMR studies. Give reasons
17. What are the different types of electronic transitions?
18. Differentiate between molarity and molality.
19. A solution containing 7g of a non volatile solute in 250g of water boils at 373.26 K. Find the molecular mass of the solute.(Kb for water is 0.52K/m)
20. Explain the terms Degree of hydrolysis and hydrolysis constant.
21. Explain reverse osmosis.
22. Calculate the mole fraction of alcohol, C_2H_5OH and water in a solution made by dissolving 9.2g of alcohol in 18g of water.

(8 X 2 = 16 Marks)

SECTION - C

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

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.

24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31x10^{-3}$ s^{-1}. Calculate the half life period of the reaction.

25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4OH per litre. Kb for NH4OH = $1.85x10^{-5}$.

26. Derive the relation between K_h, K_w and K_a.

27. Give an account of applications of colloids

28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

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

30. What is osmotic pressure? How will you determine the molecular mass of a substance with this method?

31. Explain the principle of Fractional Distillation

(6 X 4 = 24marks)

SECTION – D

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

32. (a)Differentiate between Molecularity and order of a reaction with examples (5 marks)
    (b) Discuss the Kinetic, optical and electrical properties of colloids (5 marks)
    (c) Explain the protective action of colloids(5 marks)

33. (a) Which of the following has the highest osmotic pressure: 0.1M sucrose, 0.1M acetic acid, 0.1M KCl and 0.1M Na_2SO_4 all in water? Why?
    (b) Why do you get abnormal molecular masses of the substances by using colligative properties of the solution.
    (c) Discuss in detail about the determination of molecular mass of a non volatile compound from elevation in boiling point and depression in freezing point

34. (a) Discuss the factors responsible for deviation from Raoult's law by taking suitable examples. (b) Define critical solution temperature. Explain systems having upper and lower CST using examples
    (c) Explain the applications of UV spectroscopy

35. (a)Discuss the advantages of Bronsted-Lowery concept over Arrhenius concept and also the limitations of the Bronsted-Lowery concept.
    (b) The salt of strong acid and strong base does not undergo hydrolysis. Explain.

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

(15 X 2 = 30marks)

SYLLABUS OF COMPLEMENTARY COURSE
Organic Chemistry (For Students of Botany Majors)
SEMESTER IV Course-4 Credit -3 Course Code CH1431 .3

L-T-P 3-0-2 Total 54 Hours

Module I - Chromatography (9 Hrs)

Outline study of adsorption and partition chromatography, paper , thin layer, ion exchange ,gas chromatography- principle-instrumentation and applications and HPLC - Rf and Rt value – Introduction to zone electrophoresis and capillary electrophoresis.

Module II Amino acids, Proteins (9 hrs)

Amino acids: - Classification, structure and stereochemistry of amino acids, essential and non essential amino acids, zwitter ion, isoelectric point, General methods of preparation and reactions of a - amino acids.

Peptides: structure and synthesis (Carbobenzoxy method, Sheehan method only). Proteins:- Structure of proteins, denaturation and colour reactions.

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

Module III Sterochemistry (9 hrs)

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

Module IV Oils, Fats, Detergents, Alkaloids, Vitamins and Terpenes (9 hrs.)

Oils and Fats: - Occurrence and extraction. Common fatty acids, soap, saponification value, iodine value, acid value, Alkaloids: - Extraction and structural elucidation of conine, nicotine and importance of quinine, morphine and codeine. Terpenes: - Essential oils, isolation of citral and geraniol (No structural elucidation) Isoprene and special isoprene rule. Vitamins: - Classification, structure functions and deficiency diseases (structures of vitamin A, B1 and C but no structural elucidation).

Module V Dyes (9hrs)

Theory of colour and constitution, classification of dyes, Natural dyes, indigo- Synthesis of methyl orange, congo red, malachite green, phenolphthalein, Schiffs reagent.

Module VI Drugs (9Hrs)

Classification of drugs- analgesic, antipyretic, antibiotic, hypnotics, suphadrugs, antacids, antimalarials, Synthesis of aspirin, sulphaguanidine, chloramphenicol, Drugs of plant origin anticancer compounds from plants.

References

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

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Model Question Paper of BSc Botany Programme

2017 Admission onwards

SEMESTER IV Complementary Chemistry Course Code CH1431 .3

ORGANIC CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

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

1. What is meant by Rf value?
2. Define Racemic mixture.
3. Represent the configurations of D and L glyceraldehyde.
4. Give two example of essential aminoacids.
5. Describe a colour test for proteins.
6. Define Iodine value.
7. What are antipyretics?
8. State Special isoprene rule?

9. What is mordant dye? Give one example.
10. Give the deficiency disease of Vitamin C. (10 X 1 =10Marks)

SECTION - B

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

11. Give the principle of adsorption chromatography.
12. What is meant by denaturation of proteins.
13. Discuss the importance of Morphine.
14. Which of the following are optically active ? Why?
    (i)2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane
15. Give four differences between enantiomers and diastereoisomers.
16. Write a note on the different types of RNA and its functions.
17. How are alkaloids extracted from natural sources?
18. Give the classification of Vitamins.
19. What are antacids. Explain.
20. Give the structure of Vitamin A.
21. Name three anticancer compounds from plant.
22. Explain saponification.

(2 X 8 = 16 Marks)SECTION - C

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

23. Discuss the optical isomerism of tartaric acid.
24. Write a note on DNA replication .
25. Give the synthesis of Tryptophan.
26. What is meant by Isoelectric point of aminoacids.
27. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
28. Give a brief account on Thin Layer Chromatography.
29. Write a note on the methods of isolation of terpenoids. 30.Give the synthesis of Methyl Orange

31.Explain the cleansing action of soap.

(4x6 = 24marks)

SECTION – D

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

32. (a) Explain Ion exchange Chromatography. (5 marks)
    (b)Give the structure elucidation of Conine. (5 marks)
    (c) Describe the structure of DNA. (5 marks)
33. (a) Discuss briefly the structure of Protein.
(b) Explain Sheehan's method.
(c) Discuss the classification of dyes on the basis of application.

34. (a) What is resolution? Explain different methods of resolution.
(b) What are meso compounds ? Are they optical activite ? Explain with a suitable example.
(c) Discuss the isolation, structure and uses of geraniol.
35. (a) Give the synthesis of the following drugs (i) Aspirin (ii) sulphaguanidine (b) Define Oils and fats and discuss the different methods of extraction .
(c) Write a note on detergents.
(15 X 2 = 30marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY

Course V Course Code CH1432 .3 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science, Biochemistry and Microbiology majors.

Qualitative Analysis

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

Organic preparations

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

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

A. Acidimetry and alkalimetry

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

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

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

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

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

e. Estimation of a strong acid using standardized NaOH

B. Permanganometry

a. Standardization of 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. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

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

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

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

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

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

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

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

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

Complementary Chemistry offered to Zoology Majors

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

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .4		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .4		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .4		3×18 = 54 2×18 = 36

4	3	2	3 4	CH1431 .4 CH1432 .4		3×18 =54 2×18 = 36

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry-I(Common for Botany/Zoology/Microbiology)

(For Students of Zoology Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code-CH1131 .4 Credit-2

L-T-P 2-0-2 36 Hours

Module I – Atomic Structure (9 hours)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals.

Module II – Chemical Bonding (9 hours)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+,

Module III – Analytical Principles (9 hours)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Beer- Lambert law- Principles of colorimetry - estimation of Iron and phosphate

Module IV – Environmental Chemistry (9 Hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.Dissolved oxygen-BOD,COD

References

12. Atomic structure and chemical bonding with introduction to molecular spectroscopy – Manas Chanda
13. Concise Inorganic Chemistry – J.D. Lee
14. Environmental Chemistry A. K. De
15. Modern Inorganic Chemistry A.D. Madan
16. A. I. Vogel, "Text book of Qualitative Analysis"
17. A. I. Vogel, "Text book of Quantitative Inorganic Analysis".

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
Complementary CourseZoology majors.
SEMESTER I Course Code CH1131 .4 THEORETICAL CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

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

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

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

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

16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?
18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?
20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

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

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
    (c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.
(b) Explain the theory of redox indicators.
(c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.
34. (a) Write a note on Hydrogen bonding and its consequences.
(b) How electronic configuration of molecules related to molecular behavior? Explain.
(c) Explain Fajan's Rule.
35. (a) Discuss the formation and importance of ozone layer.

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

Complementary Chemistry for Zoology Majors
Inorganic Chemistry-I(Common for Botany/Zoology/Microbiology Majors)
SEMESTER II Course code-CH1231 .4 Credit-2
(For Students of Zoology Majors)

L-T- P 2-0-2

36 hours

Module I Organometallics (9 hours)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

Module II : Nuclear Chemistry (9hours)

Natural radioactivity, modes of decay, Geiger –Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

Module III - Coordination Chemistry (9 hours)

Nomenclature, Coordination number and geometry - chelates – isomerism – structural and stereo isomerism valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – colour and magnetic properties complexes. Application of metal complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hours)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of O2 – CO2 transportation, nitrogen fixation, carbon fixation and carbon cycle. Biochemistry of iron toxicity and nutrition, essential and trace elements in biological systems.

References

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

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

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
Complementary CourseZoology majors.
SEMESTER II Course Code CH1231.4
INORGANIC AND BIOINORGANIC CHEMISTRY - I(Common for Botany/Zoology/Microbiology)

Time: Three Hours Maximum Marks: 80

Section A

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

1. Give the structure of Zeise’s salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner’s Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.

20.Differentiate respiration and photosynthesis.
21.What are trace elements?
22.What is the role of chlorophil in photosynthesis?

Section-C

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

23.Write a note on organotin compounds.
24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.
25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?
26.Explain the relation between nuclear stability and n/p ratio.
27.Write the biological effects of radiation.
28.Suggest the structure of $[NiCl_4]$ on the basis of Valence Bond Theory.
29.Explain the magnetic properties of octahedral complexes with suitable examples.
30.Discuss briefly the biochemistry of iron toxicity and nutrition.
31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent.
(b) What are Frankland reagents? Give its significance.
(c) Explain about organosilicon compounds in medicine.

33.(a) Explain carbon dating and rock dating.
(b) Give the principle of neutron activation analysis.
(c) Explain the terms nuclear fission and fusion with suitable examples.

34.(a) Write a note on Crystal Field Theory.
(b) Explain the applications of complexes in qualitative analysis.
(c) Write a brief note on isomerism in coordination complexes.

35.(a) Give brief outline of carbon cycle.
(b) Explain nitrogen Fixation.
(c) Write a short note on hemoglobin.

ORGANIC CHEMISTRY

Complementary Chemistry for ZOOLOGY MAJORS

SEMESTER III Course-3 Credit-3 Course Code – CH1331 .4

L-T-P 3-0-

2Total - 54 hoursModule I – Mechanisms in organic substitution reactions (9 hours)

Electron displacement in organic compounds – Inductive, electromeric and mesomeric effects, influence of inductive effect on acidic and basic properties of organic compounds, hyperconjugation and steric effect. Reaction mechanism - Bond fission, rate determining step, nucleophilic substitution of alkyl halides SN1 & SN2 reactions. Effect of structure on reactivity as illustrated by methyl, ethyl, isopropyl and tertiary butyl groups. Electrophilic addition to ethene and propene –Markownikoff's rule, free radical addition, peroxide effect.

Module II – Stereochemistry (9hours)

Optical isomerism, chirality, recemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism due to restricted rotation. Geometrical isomerism, E and Z nomenclature. Aldoximes and ketoximes.

Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, propane, butane, cyclohexane, axial and equatorial bonds.

Module III – Carbohydrates (9 hours)

Classification, configuration, glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose. Preparation and properties of glucose and fructose - Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected). Mutarotation and epimerization. Conversion of glucose into fructose and viceversa.

Module IV – Amino acid and Proteins (9 hours)

Classification and properties – synthesis of glycine, alanine and tryptophan – polypeptides and proteins, peptide linkage, peptide synthesis, polypeptides, primary,secondary, tertiary and quarternary structure of proteins, test for proteins, Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory – Co-enzymes.

Module V– Nucleic acids and Lipids (9 hours)

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

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

Module VI – Polymers (9 hours)

Classification with example – natural and synthetic polymers – condensation and addition polymerization. Elastic fibres, thermoplastics and thermosetting plastics. Terpenes – classification, isoprene rule, essential oils, elementary study of citral and geraniol (structure elucidation not required) Rubber - structure – Vulcanisation of rubber – synthetic rubber – neoprene, butyl rubber, Buna S, Buna N

Referances
1. Organic Chemistry Vol I and II – I.L. Finar
2. Biophysical Chemistry – Principles and Techniques – A. Upadhyay. K.Upadhyay& N. Nath 3. Reaction Mechanism in Organic Chemistry – Mukherjee and Singh – Macmillan
4. Physical Chemistry – Rakshit
5. Essentials of Physical Chemistry – Bahl, Tuli & Arun Bahl
6.Principles of Organic Chemistry – M. K. Jain, S. Nagin &Co .

University of Kerala
Model Question Paper of BSc Zoology Major
2017 Admission onwards
SEMESTER IV Complementary Chemistry Course Code CH1431 .4
ORGANIC CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

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

1. Which is more acidic acetic acid or trichloro acetic acid? Why?
2. Explain Markonikoff's rule with example
3. Represent the configurations of D and L glyceraldehyde
4. Draw the ring structures of glucose and fructose
5. Define mutarotation
6. Give two example of essential aminoacids .
7. Describe a colour test for proteins
8. Define saponification value
9. Give the name and structure of the base present in RNA but not in DNA.
10. What is vulcanization of rubber?

(1 X 10 =10Marks)

SECTION - B

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

11. Describe hyperconjugative effect with suitable examples
12. Discuss the optical isomerism of tartaric acid.
13. Which of the following are optically active ? Why?
    (i)2-chloropropane (ii)2-chlorobutane (iii)3-chloropentane
14.Give four differences between enantiomers and diastereoisomers.

15. What is meant by denaturation of proteins?
16. Distinguish between mutarotation and epimerization.
17. Classify the carbohydrates on the basis of behavior towards hydrolysis.
18. What are lipids? How will you classify them? 19.Give a test to distinguish RNA and DNA
20. How is terpenes classified?.
21. What is polymerization? Give an example of linear polymers?
22. Draw the structure of geraniol

(2 X 8 = 16 Marks)

SECTION - C

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

23. Explain SN1 and SN2 reactions? Give examples
24. Give an account of inductive effect and show how it is applied to predict the strength of organic acids?
25. Give an account of asymmetric synthesis.
26. Determine the R & S notations of meso tartaric acid and L- glyceraldehyde.
27. What are essential oils? Explain ts function with examples.
28. How is glucose is converted into fructose and vice- versa?
29. What is meant by Isoelectric point of aminoacids. 30.Classify polymers based on molecular forces

31.Explain the cleansing action of soap.

(4x6 = 24marks)

SECTION – D

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

32. (a) Explain the effect of structure on reactivity.
    (b) Explain electrophilic addition reactions with examples
    (c) What are meso compounds ? Are they optical activite ? Explain with a suitable example.

33. (a) Write notes on different conformations of ethane and cyclohexane
    (b) Give an account of the configurations of monoaccharides (c) Discuss briefly the structure of Protein.

34. (a) Discuss general physical and chemical properties of oils and fats
    (b)Describe the functions of RNA and DNA
    (c)Explain the structure of DNA

35. (a) Give an account of synthetic rubbers

(b) Discuss the classification of polymers on the basis of structure (c) Write a note on detergents.

(15 X 2 = 30marks)

PHYSICAL CHEMISTRY

Complementary Chemistry for ZOOLOGY MAJORS

SEMESTER IV Course-4 Credit-3 Course Code CH1431 .4 L-T-P 3-0-2

Total 54 hours

Module I. Chemical kinetics 9 hours

Chemical kinetics, catalysis, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions (derivation of first order only) fractional life time, units of rate constants, influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters, Collision theory, catalysis, different types of catalysis, intermediate compound formation theory and adsorption theory.

Module II. Ionic equilibrium 9 hours

Arrhenius, Lowry- Bronstead and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, Henderson equation - pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant .

Module III Colloids 9 hours

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation.

Module IV Spectroscopy 9 hours

UV-Visible Spectroscopy- absorption, types of electronic transitions, effect of conjugation, concept of chromophore, auxochrome, bathochrome, hypochromic shifts, hyperchromic and hypochromic effects. UV-Visible spectra of enes. Calculation of λmax. simple applications of UV spectroscopy, conjugation, functional group and geometrical isomerism

Principle of NMR, nuclear spin, chemical shift, spin-spin coupling, τ and δ, PMR of simple organic molecules, principle of MRI .

Module V- Instrumental methods of Chemical Analysis 9 hours

Principle – instrumentation and applications of Atomic absorption spectroscopy- flame emission spectroscopy- Thermal methods - thermogravimetry (TG) - Differential thermal analysis (DTA) - Gas Chromatography- HPLC – Introduction to zone electrophoresis and capillary electrophoresis.

Module VI Solutions 9 hours

Liquid-Liquid system:- Completely miscible, ideal and non-ideal mixtures, Raoult's law, vapour pressure- composition and temperature-composition curves, fractional distillation, deviation from Raoult's law, Azeotropic mixtures, partially miscible liquid system, critical solution temperature, Conjugate layers, example for upper, lower and upper cum lower CST, Theory of steam distillation

Referances

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

University of Kerala
Model Question Paper for Zoology Major
2017 Admission onwards
SEMESTER IV Complementary Course.IV Course Code CH1431 .4
PHYSICAL CHEMISTRY

Time:3hours Max.Marks : 80

SECTION – A

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

1. What are the units of rate constants for first and second order reactions?
2. Give one example of a reaction in which order and molecularity have different values.
3. Define P^H.
4. State Hardy-Schulze rule.
5. Distinguish between lypophilic colloids and lypophobic colloids.
6. Define chemical shift
7. Explain chromophore with an example.

8. What is meant by a buffer solution? Give one example each for acid buffer and basic buffer solution.
9. What is meant by the term ideal solution?
10. Write a short note on zone electrophoresis

SECTION - B

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

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

(8 X 2 = 16 Marks)

SECTION - C

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

23. What is energy of activation? What happens to the energy of activation in presence of a catalyst.
24. Explain Half life period of a reaction. A first order reaction has a specific reaction rate of $2.31x10^{-3}$ s^{-1}. Calculate the half life period of the reaction.
25. Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1mole of NH_4 OH per litre. Kb for NH4OH = $1.85x10^{-5}$.
26. Derive the relation between K_h, K_w and K_a.
27. Give an account of applications of colloids
28. Explain ultra filtration and electrodialysis techniques used for the purification of colloids

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

30. Briefly explain TGA taking suitable example

31. Explain the principle of Fractional Distillation

(6 X 4 = 24marks)

SECTION – D

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

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

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

(c) Explain the protective action of colloids

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

(b) Distinguish between AAS and FES

(c) Explain the applications of TGA and DTA

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

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

(c) Explain the applications of UV spectroscopy

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

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

(c) Explain the underlying principle in an NMR spectrum and interpret the low resolution NMR

spectrum of ethanol molecule. (15 X 2 = 30marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V

Course Code CH1432 .4 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science Biochemistry and Microbiology majors

Qualitative Analysis

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

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene

3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

I.Acidimetry and alkalimetry

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

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

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

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

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

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

d. Standardization of KMnO4 by oxalic acid/sodium oxalate and Mohr's salt e. Estimation of oxalic acid/sodium oxalate

f. Estimation of Mohr's salt

g.Estimation of calcium

III.Dichrometry

h. Preparation of Std. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

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

IV.Iodimetry and Iodometry

j. Standardisation of sodium thiosulphate using std potassium dichromate k. Estimation of copper in a solution

l. Estimation of iodine.

V.Complexometric titrations

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

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

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

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals

2.Estimation of barium in barium chloride solution.

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

Complementary Chemistry offered to Homescience and Biochemistry Majors

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

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .5		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .5		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .5		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .5 CH1432 .5		3×18 =54 2×18 = 36

Syllabus for complementary courses

(Common for Homescience & Biochemistry)

(for Homescience Majors)

Semester-1 Complementary Course No. - 1 Course Code CH1131.5

Credit-2

Inorganic and Analytical Chemistry L-T-P 2-0-2 36 hrs

Module I –Atomic structure 9 hrs

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

Module II- Analytical Principles 9 hrs

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

Module III- Radioactivity and Nuclear Chemistry 9 hrs

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

Module IV- Organometallics and biomolecules 9 hrs

Organometallic compounds –Definition and classification, Biological and environmental aspects of organometallics-organometallics in medicine ,Organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin. References

1. Concise Inorganic Chemistry J. D. Lee

2. Inorganic Chemistry Puri and Sharma

3. Chemistry of Organometallics Rochow

4. Organic Chemistry Vol 2 I.L. Finar

5. Chemistry of natural products Vol. 1 Gurdeep Chatwal

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

7. Modern Inorganic Chemistry R D Madan

Model Question paper for S1 Complementary Chemistry Course - II Semester

1 CH1231 .5 (For Students of Homescience and Biochemistry majors)

Organic Chemistry

Time : Three Hours Total marks : 80

Section – A

(Very short answer questions)

Answer all questions. Each question carries 1 mark (1×10=10)

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

Section – B

(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. Calculate the weight of Na_2Co_3 required to prepare250ml N/10 solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes?

Section – C

(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?
25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?

28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine?

Section – D

(Long Essay Questions)

Answer any two. Each question carries 15 marks (15×2=30)

32. Derive the Bohr frequency equation?(10marks)
    b) Explain quantum numbers.
33. a)Write notes on Acid base indicators? (10mark) b)Explain the Permanganometric titration? (5mark)
34. a)What are the applications of radioactivity in medicine and agriculture? (10mark)
    b).What is meant by neutron activation analysis? (5mark)
35. a) Write in detail the classification of Organometallic compounds with examples? (10Mark)
    b) Explain the biological aspects of myoglobin? (5marks)?

Syllabus(Complementary course Chemistry)

(For Students of Homescience Majors)

(Common for Homescience &Biochemistry)SEMESTER 2 Course No. 2

Course Code . CH1231 .5 Credit 2 Organic Chemistry

L-T-P 2-0-2 36 hrsModule I: Carbohydrates 9hrs

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

Module II Vitamins 9hrs

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

Module III :Aminoacids and Proteins 9hrs

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

Module IV: Enzymes and Hormones 9hrs

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

Hormones- Introduction, isolation, functions and abnormalities due to oxytocin, thyroxin, adrenalin, glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin References

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

Model Question paper for S2 Complementary Chemistry Course - II Semester 2
CH1231 .5 (For Students of Homescience and Biochemistry majors)
Organic Chemistry

Time : Three Hours Total marks : 80

Section – A
(Very short answer questions)
Answer all. Each question carries 1 mark. (1×10=10)

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

Section – B

(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?
18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation?

Section – C

(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

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

Section – D

(Long Essay Questions)

Answer any two. Each question carries 15 marks (2×15=30)

32. a) Explain the structure of protein. (10 marks)
    b) Write a note on the synthesis of aspartic acid (5 marks)
33. a) Write notes on the different types of vitamins. (10 marks)
    b) Explain the deficiency disease caused by vitamin B and D. (5 marks)
34. Discuss about

a) The different types of hormones. (10 marks)
b) Enzyme inhibitors. (5 marks)

35. Write in detail
a) The classification of Carbohydrates. (10 marks)
b) Ergocalciferol (5 marks)

Syllabus (Complementary course Chemistry)
(For Students of Home Science majors)
SEMESTER 3 Course-3 Credit-3 Course Code – CH1331 .5L-T-P 3-0-2
Organic Chemistry II Total - 54 hrs

Module 1: Colloids 9hrs

Introduction, dispersed phase, dispersion medium, classification, multi molecular, macromolecular and associated colloids. Preparation - condensation and dispersion methods, purification -dialysis and ultra filtration, properties of colloidal solution-optical, kinetic and electrical properties, coagulation, Hardy-Schultz rule, protective colloid, applications of colloidal systems, emulsions, emulsifiers and cleansing action of soap.

Module 2: Adsorption and Chromatography 9hrs

Adsorption-Adsorbent, adsorbate, desorption, types of adsorption, physical and chemical adsorption, kinds of adsorption, interactions, adsorption of gases and solutions on solids, importance of adsorption phenomena(applications)- adsorption in catalysis, Chromatography-Column, TLC, paper and gas chromatography.

Module 3: Colour and constitution, Dyes 9hrs

Colours, complimentary colours, chromophore-auxochrome theory, modern theory of colours, classification of dyes, preparation and uses of para red and methyl orange, phenolphthalein and fluorescein , Alizarin, malachite green

Module 4: Terpenes 9hrs

Introduction, isolation, occurrence, isoprene rule, classification, physical and chemical properties and uses of citral, geraniol, menthol and camphor. An elementary idea of the structure of natural rubber, synthetic rubber, Buna-N, Buna-S, Neoprene and Thiokol.

Module 5: Alkaloids 9hrs

Occurrence, general methods of isolation, functional group analysis, functional nature of oxygen containing groups -OH,-COOH,-CHO, >C= O groups, nature of nitrogen, Hoffmann exhaustive methylation, structure and physiological actions of coniine, nicotine, quinine, morphine and codeine (structure elucidation is not expected)

Module 6: Polymers 9hrs

Natural and synthetic polymers, preparation and uses of vinyl polymers-PE, PVC, PVA, PS, PVF, PMMA, PTFE, Synthetic fibres-Nylon, Nylon 66,Terylene, Di methyl teraphthalat, polymers in medicine and surgery

References

1. Chemistry of natural products Vol. 1 — Gurdeep Chatwal
2. The Text Book of Organic Chemistry — P.L Soni, H.M. Chowla
3. Organic Chemistry Vol 1 & 2 — I.L. Finar
4. The Text Book of Organic Chemistry — Arun Bahl & B S Bahl
5. Polymer Chemistry — B.K Sharma
6. Inorganic Polymer Chemistry — G S Misra

Model question paper for S_3
Complementary Chemistry for Home Science
Semester III Course Code CH 1331.5 Course III

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1. What are gels.
2. What is meant by Brownian movement.
3. An alkaloid present in hemlock herb.
4. Enthalpy of adsorption is negative .true or false 5 Name an adsorbent in paper chromatography.
6. What are complimentary colours?
7. Explain chromophore with an example.
8. Draw the structure of citral.
9. How many isoprene units are in sesquiterpenes ?
10. Write any two uses of PVC.

Section B

Answer any 8 questions (Marks-2 for each)

11. Write a note on electrical double layer and zeta potential.
12. Distinguish between coagulation and peptisation.

13 Write a note on Gibb's adsorption isotherm.

14. Write any two applications of adsorption.

15. How will you prepare phenolphthalein?

16.What is mordant dye? Give an example

17.What is Buna rubber?

18. Write the reaction of citral with silver oxide.

19.Draw the structure if morphine.

20. How is the functional nature of OH analysed in alkaloids ?

21. What is Bakelite?

22. Give the structure of Nylon 66.

Section C

Answer any 6 questions (Marks -4 for each)

23.What are micelles. Define critical micelle concentration.

24. What is gold no.explain protective colloid ?

25. What do you understand by physical and chemical adsorption?

26. Explain the isomerism shown by citral and geraniol

27. What is Hoffmann exhaustive methylation

28. Write the structure and physiological actions of nicotine

29. What are terpenes. Discuss isoprene and special isoprene rule.

30. How is polystyrene synthesized?

31. Write a note on polymers in medicine and surgery.

Section D

Answer any 2 questions (Marks -15 for each)

32. a)Explain adsorption chromatography b) Write a note on partition chromatography ?

33.Give preparation and uses of 1)PVC 2)PMMA 3)Terylene 4)PTFE 5)PVF?

34. Discuss the various theory of a) colour b) constitution.

35. a) What are emulsifiers? Explain the cleansing action of soap. b) Explain the Hardy- ` ` Schultz rule?

Syllabus (Complementary course Chemistry)
(For Students of Home Science majors)
SEMESTER 4 Course-4 Credit-3Course Code – CH1431 .5Organic and Medicinal Chemistry

L-T-P 3-0-2 **Total- 54 hrs**

Module-1: **Medicinal Chemistry** 9hrs

Chemo therapy-Drugs- Classification, Elementary study of analgesics, antipyretics, antibiotics, antimalarials, sulphadrugs, mode of action of drugs, synthesis of aspirin and paracetamol

Module-2: Food additives 9hrs

Preservatives –Calcium propionate, sodium benzoate and sodiumbisulphite antioxidants-Structure and functions of Butylated hydroxy anisole(BHA), Butylat hydroxy toluene(BHT),Vitamine A,E and C. Artificial sweeteners –Structure and applications of saccharin, aspartame and cyclamate. Emulsifiers-chitin

Module-3: Heterocyclics 9hrs

Introduction, Classification and nomenclature. Isolation, preparation, physical properties, acidic and basic character, addition , substitution, oxidation and resonance structures of of pyrrole, furan, thiophene and pyridine.

Module-4: **Insecticides and pesticides** 9hrs

Insecticides - classification and preparation of compounds like DDT, DDE and BHC. Methoxy chlor, malathion, parathion and carbamates(mention only).

An elementary study of antiseptics, disinfectants, pesticides, rodenticides, herbicides and fungicides.

Module-5:Environmental Chemistry -I 9hrs

Air and soil pollution-Introduction, different types of air and soil pollution, air pollutants SO_2, SO_3, NO,.NO_2 and smog. Acid rains, CO_2, CO, green house effect, O_3, importance of ozone layer, causes and effects of ozone layer depletion. Aerosol, photochemical oxidants, PAN, hydrocarbons, particulates, dust, smoke, asbestos, lead mercury, cadmium. Control of air pollution

Module-6:Environmental Chemistry - II 9hrs

Water pollution-Factors affecting the purity of water, sewage water, Industrial waste, agricultural pollution such pesticides, fertilizers, detergents; treatment of industrial waste, water using activated charcoal, synthetic resins, reverse osmosis and electro dialysis.

References

1.An Introduction to Medicinal Chemistry Graham L Patrick Indian Edn

2.Food Chemistry L. H. Mayer

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

4. Organic Chemistry Vol 1 & 2 I.L. Finar

5. The Text Book of Organic Chemistry Arun Bahl & B S Bahl

6. K. Banerji, “Environmental Chemistry”.

7. A. K. De “Environmental Chemistry - An introduction”

8. B. K. Sharma “Air Pollution”

9.G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective

Model question paper for S_4

Complementary Chemistry for Home Science majors
Semester 1V Course Code CH 1331.5 Course IV

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1. What are antimalarials? Give one example?
2. Name a sulpha drug?
3. Write two examples for food preservatives?
4. Draw the structure of aspartame?
5 What are Heterocyclics? And give any one hector cyclic compounds?
6. Give the reaction showing the acidic character of furan?
7. What is DDT, DDE?
8. What is an acid rain?
9. What is a smog ?
10. What are detergents?

Section B

Answer any 8 questions (Marks-2 for each)

11. Name two antibiotics?
12. What is BHT? What are its fuctions?
13 How thiophene is isolated?
14. What is an aerosol? Give an example?
15. What are herbicides and fungicides?
16. How will you control of air pollution?
17. What are photochemical oxidants?
18. What is reverse osmosis?
19. What is meant by green house effect. And name two green house gases?
20. Write two chemicals used for sterilization?
21. What are the uses of methoxychlor?
22. What is chitin?

Section C

Answer any 6 questions (Marks -4 for each)

23.What are the mode of action of drugs?.

24. Give the synthesis of aspirin ?

25. Explain the preparation and properties of furan?

26. What are the different types of pollutants in air?

27. Explain the electro dialysis?

28. How will you synthesis paracetamol?

29. Write of Butylated hydroxy anisole(BHA)?

30. Draw the resonance structure of pyridine?

31. Write a note on disinfectants and rodenticides?

Answer any 2 questions (Marks -15 for each)

32. a) Give an outline of a) air pollution b) soil polution?

33.Write the importance of a)ozone layer b) causes and effects of ozone layer depletion?

34. Write the structure and applications of saccharine, aspartane and cyclamate?

35. a) What are the factors affecting the purity of water. b) Explain the treatment of industrial waste?

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V
Course Code CH1432 .5 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science, Biochemistry and Microbiology majors.

Qualitative Analysis

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

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene
3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

I.Acidimetry and alkalimetry

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

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

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

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

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

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

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

c.Estimation of Mohr's salt

d.Estimation of calcium

II.Dichrometry

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

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

III.Iodimetry and Iodometry

a.Standardisation of sodium thiosulphate using std potassium dichromate

b.Estimation of copper in a solution

c.Estimation of iodine

IV.Complexometric titrations

a.Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution. b.Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

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

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1.Estimation of water of hydration in barium chloride crystals

2.Estimation of barium in barium chloride solution.

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

Complementary Chemistry offered to Biochemistry Majors

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

Chemistry Complementary

Complementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .6		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .6		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .6		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .6 CH1432 .6		3×18 =54 2×18 = 36

Syllabus for complementary courses

(for Bio Chemistry Majors)

Semester-1 Complementary Course No. - 1 Course Code-CH1131 .6Credit-2

Inorganic and Analytical Chemistry 36 hrs

L-T-P 2-0-2

Module I –Atomic structure 9 hrs

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

Module II- Analytical Principles 9 hrs

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

Module III- Radioactivity and Nuclear Chemistry 9 hrs

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

Module IV- Organometallics and biomolecules 9 hrs

Organometallic compounds –Definition and classification, Biological and environmental aspects of organometallics-organometallics in medicine ,Organo mercury, boron, silicon and arsenic compounds. Biomolecules –Metallo porphyrins, Haemoglobin and Myoglobin. References

1. Concise Inorganic Chemistry J. D. Lee

2. Inorganic Chemistry Puri and Sharma

3. Chemistry of Organometallics Rochow

4. Organic Chemistry Vol 2 I.L. Finar

5. Chemistry of natural products Vol. 1 Gurdeep Chatwal

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

7. Modern Inorganic Chemistry R D Madan

Model Question paper for S1 Complementary Chemistry Course - II
Semester
1 CH1231 .5 (For Students of Biochemistry majors)
Organic Chemistry

Time : Three Hours Total marks : 80

Section – A
(Very short answer questions)

Answer all questions. Each question carries 1 mark (1×10=10)

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

Section – B
(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. Explain the Hund's rule with a suitable example?
12. Draw the shapes of d-orbitals?
13. What is meant by normality and molarity?
14. Why HCl is not used in Permanganomertic titration?
15. Calculate the weight of Na_2Co_3 required to prepare250ml N/10 solution?
16. What is binding energy?
17. What is meant by radio carbon dating??
18. Name four radioactive elements used in medicine?
19. What are organo boron compounds? Give one example?
20. What are anti tumour drugs??
21. What are biomolecules? Give two examples?
22. What are silatranes?

Section – C
(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

23. i)Explain the wave nature of material objects? ii) What is uncertainty principle?
24. Explain the concepts of orbitals?

25. Explain the theory of acid base titrations?
26. Write a note on dichromatic titration?
27. Write the stability of nucleus with respect to n/p ratio ?
28. What is meant by biological effect of radiation?
29. How will you detect radioactivity by Wilson cloud Chamber?
30. What are the functions of Haemoglobin?
31. Write a note on Organoarsenic compounds in medicine?

Section – D

(Long Essay Questions)

Answer any two. Each question carries 15 marks (15×2=30)

32. Derive the Bohr frequency equation?(10marks)
    b) Explain quantum numbers.
33. a)Write notes on Acid base indicators? (10mark) b)Explain the Permanganometric titration? (5mark)
34. a)What are the applications of radioactivity in medicine and agriculture? (10mark)
    b).What is meant by neutron activation analysis? (5mark)
35. a) Write in detail the classification of Organometallic compounds with examples? (10Mark)
    b) Explain the biological aspects of myoglobin? (5marks)?

Syllabus for complementary courses

(for Bio Chemistry Majors)

(Common for Homescience &Biochemistry) Semester-II Complementary Course No. - 1 Course Code-CH1231 .6Credit-2 L-T-P 2-0-2

Module I: Carbohydrates 9hrs

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

Module II Vitamins 9hrs

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

Module III :Aminoacids and Proteins 9hrs

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

Module IV: Enzymes and Hormones 9hrs

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

Hormones- Introduction, isolation, functions and abnormalities due to oxytocin, thyroxin, adrenalin, glutathione, progesterone, estrogens, cortisone, corticosterone, adrenalin References

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

UNIVERSITY OF KERALA

Model Question paper for Complementary Chemistry Course - II Semester 2

CH1231 .6 (For Students of biochemistry majors)

Organic Chemistry

Time : Three Hours Total marks : 80

Section – A(Very short answer questions)

Answer all. Each question carries 1 mark. (1×10=10)

1. Write the name of a neutral aminoacid?
2. Give the name of an essential aminoacid?
3. What is peptide linkage?
4. Give the name of a monosaccharide?
5. Write one reaction of glucose?
6. What is a carbohydrates?
7. Give the other name of oxytocin?
8. Give the name of two enzymes?
9. Give two functions of enzymes?

10. Which vitamin is called antihaemorrhagic vitamin?

Section – B
(Short Answer Questions)

Answer any eight. Each question carries 2 marks (2×8=16)

11. What are peptides?
12. What is Zwitter ion?
13. What is the building block of proteins?
14. Give a test for protein?
15. What are enzyme inhibitors?
16. What is a substrate?
17. What is optimum temperature for enzyme action?
18. What are hormones?
19. Draw the structure of vitamin A?
20. What is epimerization?
21. What is Mannose?
22. What is mutarotation?

Section – C
(Short Essay Questions)

Answer any six. Each question carries 4 marks (4×6=24)

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

Section – D
(Long Essay Questions)

Answer any two. Each question carries 15 marks (2×15=30)

32. a) Explain the structure of protein. (10 marks)
    b) Write a note on the synthesis of aspartic acid (5 marks)
33. a) Write notes on the different types of vitamins. (10 marks)
    b) Explain the deficiency disease caused by vitamin B and D. (5 marks)
34. Discuss about
    a) The different types of hormones. (10 marks)
    b) Enzyme inhibitors. (5 marks)

35. Write in detail
    a) The classification of Carbohydrates. (10 marks)
    b) Ergocalciferol (5 marks)

Syllabus for complementary course
(for Biochemistry Majors)
Semester-3 Course-3 Credit-3Course Code – CH1331 .6Inorganic and Organic Chemistry and Spectroscopy Total - 54hrsL-T-P 3-0-2Module I: Chemical Bonding
9hrs

Energies of bond formation Born-Haber cycle, hybridization and structure of molecules-sp, sp^2,sp^3,dsp^2,dsp^3,sp^3d^2 hybridisation with examples, explanation of bond angle in water and ammonia, VSEPR Theory with regular and irregular geometry , polarity of covalent bond, its relation with electronegativity, electronegativity scale-Paulings and Mullickens approaches, factors influencing polarity, dipole moment, its relation to geometry, hydrogen bond, intra and intermolecular hydrogen bond, its consequence on BP, volatility and solubility, partial covalent character of ionic bond, Fajan's rule

Module II: Coordination Chemistry 9hrs

Nomenclature, coordination number, geometry, chelates, isomerism, structural and stereoisomerism, Valence Bond theory of bonding in octahedral and tetrahedral complexes, high spin and low spin complexes, drawbacks of Valence Bond theory, magnetic properties and application in qualitative and quantitative analysis

Module III :Mechanism in Organic Substitution Reactions 9hrs

Electron displacement in organic molecules, inductive, electromeric and mesomeric effects, hyper conjugation and steric effect , bond fission, rate determining step nucleophilic substitution of alkyl halides, SN1, SN2 reactions, effect of structure on reactivity as illustrated by methyl, ethyl, isopropyl and tertiary groups, aromatic electrophilic substitution

reactions, directive influence Module IV: Stereochemistry
9hrs

Optical isomerism, chirality, racemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism, E and Z nomenclature, aldoxims and ketoxims, rotational isomerism, rotation about carbon – carbon single bond, conformation of ethane, propane, butane, cyclohexane, axial and equatorial bonds

Module V : Spectroscopy – I 9hrs

Regions of electromagnetic spectrum interaction radiation with matter, different types of energy levels in molecules, rotation , vibration and electronic levels, various types of molecular spectra, microwave spectroscopy, spectra of diatomic molecules, expression for rotational energy, selection rules, frequency separation, equation for frequency of vibration, expression for vibrational energy, selection rule, calculation of force constant

Module VI: Hetrocyclics and Alkaloids 9hrs

An outline study of the preparation and propertifs of Furan, Pyrrole, Thiophene, Pyridine, Hoffmans exhaustive methylation, Alkaloids, general method of isolation, general properties, physiological action of alkaloids, conine, morphine and nicotine(no structural elucidation expected) References :

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley
2. Concise Inorganic Chemistry : J. D. Lee, ELBS
3. Inorganic Chemistry : J. E. Huheey
4. Coordination Chemistry : Bosolo and Johns
5. Organic Chemistry : Peter Sykes
6. Organic Chemistry : F. A. Carey, Mc Graw Hill
7. Organic Chemistry : Morrison & Boyd
8. Reaction Mechanism of Organic Chemistry : S. M. Mukherji and S. P. Singh, Mc Millan

9.Spectrscopy Y R Sharma.

10.Advanced Organic Chemistry :Jerry March

Model Question Paper for Complementary Chemistry for Biochemistry Majors Semester III Course Code CH 1331.5

Total Mark:80

Time: 3 hours

Section A

Answer all questions (Marks -1 for each)

1.What is meant by hybridization?

2. What is the structure of SP_2molecule.
3. What is the geometry of SF_6 ?
4. What is the non-linear hybridisation in octahedral complexes?
5. What are chelates?
6. What is inductive effect?
7. Which is the most stable conformation of ethane?
8. Write the selection rule for vibrational spectrum ?
9. Write an expression for force constant ?
10. Write any two properties of alkaloids? **Section B**

Answer any 8 questions (Marks-2 for each)

11. Explain VSEPR theory?
12. What is meant by structural isomerism?

13 What is meant by hyperconjugation?

14. Write a note on steric effect?
15. Explain the conformation of ethane?
16. What are axial and equatorial bonds?
17. What are ketoximes?
18. What are the various types of molecular spectra?
19. Discuss the various types of energy level in molecule?
20. What are the physiological action of alkaloids? ?
21. Write the properties of nicotin?
22. Write the structure of Thiophene?

Section C

Answer any 6 questions (Marks -4 for each)

23.Explain Pauling's electronegativity scale?

24. Explain using valance bond theory, the bonding in tetra hedral complexes ?
25. What are high spin and low spin complexes?
26. Write in detail about hydrogen bonding?
27. What is Hoffmann's exhaustive methylation?
28. Give the expression for the frequency of vibration in vibrational spectroscopy and explain the terms?
29. Explain asymmetric synthesis with an example?
30. Write a note on the isolation of alkaloids?
31. How will you determine bond length in a molecule using microwave spectra?

Section D

Answer any 2 questions (Marks -15 for each)

32. Explain a) Born- Haber cycle (b) Derive an expression for vibrational energy?
33. a)Explain the magnetic properties of co-ordination compounds b) Explain the methods of resolution?
34. a)What are the difference between SN_1 andSN_2 reaction. b) Effect of the structure of bond reactivity on methyl, ethyl, isopropyl and tertiary groups?
35. a)What are alkaloids b)Explain the preparation and properties of Furan, Pyrrole, Pyridine.

c) Write a note on the Physiological action of morphine, conine?

Syllabus for complementary course
(for Biochemistry students)
Semester-4 Course-4 Credit-3Course Code –CH1431
.6Organic Chemistry and Spectroscopy-II

L-T-P 3-0-2 Total 54hrs

Module I: Chromatography 9hrs

Adsorption and partition chromatography, column, paper and thin layer chromatography, Rf value, applications, gas chromatography, applications, ion- exchange chromatography, applications

Module II :Nucleic acids and Lipids 9hrs

Nucleic acids: RNA and DNA, their biological role, hydrolysis of nucleoproteins, elementary idea regarding the structure of nucleic acids, Lipids: Classification, oils, fats and waxes, iodine value, saponification value, properties of oils and fats, phospholipids

Module III :Polymers and Terpenes 9hrs

Polymers- Classification with examples- natural and synthetic condensation and addition polymerization, elastic fibre, thermoplastics and thermosetting plastics, Rubber structure, lectrophores of rubber, neoprene, butyl rubber, Buna-S, Buna-N, synthetic polymers, Nylon-6, Nylon-66, Bakelite, elementary idea of the structure of natural rubber, Terpenes- classification, isoprene rule, essential oils, elementary study of citral and geraniol(structural elucidation not required)

Module IV :Biophysical Analysis 9hrs

Osmosis osmotic pressure, isotonic solution, determination of molar mass by osmotic pressure method, reverse osmosis, adsorption – types of adsorption, applications factors influencing adsorption, Langmuir theory of adsorption

Module V: Colloids 9hrs

Properties of colloids , Tyndal effect, ultra microscope, Brownian movement, lectrophoresis, electroosmosis, sedimentation and streaming potential stability of colloids, Zeta potential, Hardy- Schultz protective colloids, gold number, emulsion, gels, application of colloids, delta formation, medicines, sewage disposal, emulsification and cleansing action of detergents and soaps.

Module VI :Spectroscopy II 9hrs

Raman spectroscopy, stokes and antistokes lines, quantum theory of Raman spectrum, advantages and disadvantages of Raman spectrum, rotational Raman, vibrational Raman spectrum, complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnetic field, chemical schift, spin-spin coupling, applications

References :

1. Basic Inorganic Chemistry : F. A. Cotton G. Wilkinson and P. L. Gaus, Wlley

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

Model Questions Semester IV (for Bio chemistry Majors) Course Code CH1431 .6 Course – IV

Organic Chemistry and Spectroscopy II

Time : Three Hours Maximum marks: 80 marks

Section A

Answer all.(answer in one word \ sentence)

1.What is Rf value?
2.The chromatographic method where the components are separated in stacks is called
3.Which sugar is present in RNA?
4.Write the expression of Langmuir's adsorption isotherm 5.Write the expansion of DNA.
6. Name one lipid.
7. Name the components obtained on hydrolysin nucleoprotein.
8. Name the two main types of polymers.
9. W h a t i s Nylon 66 ?
10. Which is the monomer of natural rubber?

Section B

Answer any 8. Each question carries 2 marks (short answer type)

11. What are Stokes and anti Stokes lines?
12. Write in brief "Ion exchange chromatography."
13. What is paper chromatography.
14. What is iodine value ?
15. Explain saponification value.
16. What are terpenes ?
17. Explain the stereochemistry of double bond in natural rubber..
18. What are isotonic solutions ?
19. What is Tyndall effect ?

20. What is Hardy-Schultz rule?
21. Explain mutual exclusion rule ?
22. What is chemical shift? 1×8 = 8

Section C

Answer any 6. Each question carries 4 marks (short e ssay)

23. Write a note on partition chromatography.
24. Explain biological roles of RNA and DNA.
25. Distinguish between addition and condensation polymerization.
26. Distinguish between thermoplastics and thermosetting plastics.
27. Which are the different types of adsorption and the factors influencing adsorption.
28. Define elecrophoresis and electro osmosis.
29. Explain the terms (1) emulsion (2) gel
30. Explain spin-spin coupling in nmr spectroscopy.
31. Draw the high resolution nmr spectrum of ethanol and explain the peaks.

4×6 = 24

Section D

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

32. (a)Briefly explain the theory and principle of NMR spectroscopy.
(b) Why Raman spectrum is complementary with IR spectrum.

33. (a) Write a short note on the applications of chromatography. (b) Write a note on the biological role of nucleic acid.

34.(a) How is molar mass determined by osmotic pressure method.
(b) Writ a note on cleansing action of soaps and detergents.

35.(a) Explain in detail the applications of colloids.
(b) Explain isoprene rule with an example. 2x15=30

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY

Course V Course Code CH1432 .6 Credit 2 Semesters 1,2,3 & 4

For students of Botany, Zoology, Home Science Biochemistry and Microbiology majors

Qualitative Analysis

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

Organic preparations

1.Acetanilide from aniline

2.Metadinitrobenzene from nitro benzene

3.Benzoic acid from benzyl chloride

A student has to analyse at least twelve organic compounds.

I.Acidimetry and alkalimetry

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

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

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

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

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

e. Estimation of a strong acid using standardized NaOH

II.Permanganometry

a.Standardization of 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

III.Dichrometry

a.Preparation of Std. $K2Cr_2O_7$ and estimation of ferrous iron by external and internal indicators.

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

IV.Iodimetry and Iodometry

a.Standardisation of sodium thiosulphate using std potassium dichromate

b.Estimation of copper in a solution

c.Estimation of iodine

V.Complexometric titrations

a.Standardisation of EDTA using std Mg^{2+} or Zn^{2+} ion solution. b.Estimation of any one metallic ion from Ca^{2+}, Mg^{2+}, Zn^{2+} or Ni^{2+}

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

Gravimetric Analysis

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

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

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

Complementary Chemistry offered to Microbiology Majors

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

Chemistry ComplementaryComplementary Courses -4 Total Credits – 14

One Semester – 18Weeks

Sem	Hours\ Week Theory	Lab	Number Of Credits	Course	Title of Course	Instructional Hours
1	2	2	2	CH1131 .7		2×18 = 36 2×18 = 36
2	2	2	2	CH1231 .7		2×18 = 36 2×18 = 36
3	3	2	3	CH1331 .7		3×18 = 54 2×18 = 36
4	3	2	3 4	CH1431 .7 CH1432 .7		3×18 =54 2×18 = 36

QuestionPaperPatternforTest		
QuestionNo	*Typeof Question*	*Marks*
Part A: 1-2	One word or a sentence	1
Part B: 3-6	2 out of 4; Short Answer	2
Part C: 7-8	1 out of 2; Short Essay	4
Part D: 9-10	1 out of 2; Long Essay	15
		Total = 25

SYLLABUS OF COMPLEMENTARY COURSE

Theoretical Chemistry(Common for Botany/zoology/Microbiology) (For Students of Microbiology Majors)

SEMESTER 1 Complementary Course No. - 1 Course Code-CH1131 .7 Credit-2

L-T-P 2-0-2 36 hours

Module I – Atomic Structure (9 hrs)

Atomic spectrum of hydrogen - different series, Rydberg equation, Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (mention only, no derivation), concept of orbitals, the four quantum numbers and their significances. Orbitalwise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half filled orbitals. Electronic configuration of lanthanides and actinides, Lanthanide contraction

Module II – Chemical Bonding (9 hrs)

Energetics of bond formation – Born-Haber cycle. Hybridisation and structure of molecules – sp, sp^2, sp^3, dsp^2, dsp^3, sp^3d^2 and sp^3d^3 hybridisation with examples. Explanation of bond angle in water and ammonia. VSEPR theory with regular and irregular geometry –. Hydrogen bond – inter and intra molecular – its consequences on boiling point – volatility and solubility. Partial covalent character of the ionic bond – Fajan's Rules. A brief review of molecular orbital approach

– LCAO method – bond order, bond distance and stability of O2, $O2^{2+}$, $O2^{2-}$, NO, NO^+, CO and

HF.

Module III – Analytical Principles (9 hrs)

Principles of volumetric analysis – primary standard – standard solutions normality and molarity, theory of acid-base titrations, permagnometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators. Principles of colorimetry – estimation of iron and phosphorous.

Module IV – Environmental Chemistry (9hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.Dissolved oxygen-BOD,COD analysis.

References:

1. " Atomic structure and chemical bonding with introduction to molecular spectroscopy" – Manas Chanda
2. " Concise Inorganic Chemistry" – J.D. Lee
3. "Inorganic chemistry", Puri, Sharma and Kalia

4. “A text book of Quantitative analysis” A.I.Vogel
5. “Qunatitative analysis: laboratory manual”: Day & Underwood.
6. “Theoretical Principles of Inorganic Chemistry”: Manku.
7.S. K. Banerji, “Environmental Chemistry”.
8.A. K. De “Environmental Chemistry - An introduction”
9.B. K. Sharma “Air Pollution”.
10.V. K. Ahluwalia “Environmental Chemistry”
11.G.W. vanLoon and S. J. Duffy “Environmental Chemistry: A global perspective”

University of Kerala
Model Question Paper of BSc Chemistry Programme
2017 Admission onwards
SEMESTER I Complementary CourseMicrobiology majors. Course Code CH1131.7
THEORETICAL CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

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

1. Give the electronic configuration of Copper (atomic umber 29) 2.
The quantum numbers n = 2 and l = 1 corresponds to which orbital?
3. What are the shapes of molecules with sp and sp3 hybridization?
4. Calculate the bond order of H_2 molecule.
5. Give the structure of XeO_3.
6. What is Lattice Energy?
7. What is meant by primary standards?
8. Define Molality.
9. What is the optimum value of DO for good water quality?
10. What is meant by BOD?

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is Bohr Bury's rule?
12. Write down the Schrodinger Equation and explain the terms involved.
13. Explain the failures of Bohr's theory?
14. What are the limitations of VSEPR Theory?
15. What are polar and non polar covalent bonds?
16. Mention the rules for adding electrons to molecular orbitals?
17. What are dichrometric titrations?
18. How would you prepare 100ml of 0.05M Mohr's salt solution?
19. Methyl orange is not a suitable indicator for the titration of weak acid with strong base. Why?

20. Which are green house gases? Mention their sources.
21. What is reverse osmosis? How it is useful in the purification of waste water?
22. What are chief factors responsible for water pollution?

Section-C

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

23. If the energy difference between two electronic states of hydrogen atom is 214.68 KJmol1. What will be the frequency of light emitted when the electrons jump from the higher to the lower level?
24. Explain the stability of half filled and completely filled orbitals.
25. Give an account of permanganometric titrations.
26. Discuss the theory of Acid – Base indicators.
27. Explain the energetic of ionic bond formation.
28. Define hybridization. Mention the types of hybridization involved in SF6, PCl5, BF3.
29. Explain Born-Haber Cycle considering the formation of NaCl as an example.
30. Write a note on agricultural pollution.
31. Explain briefly the different methods for the treatment of industrial waste water.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32. (a) Discuss Bohr Theory, highlighting its merits and demerits. (b)What are quantum numbers? Give its significance.
    (c) Explain various rules regarding electronic configuration.
33. (a) Discuss the titration curves for the titration of strong acid with strong base and weak acid with strong base.
    (b) Explain the theory of redox indicators.
    (c) explain Beer's Law, Lambert's Law and Beer – Lambert Law.
34. (a) Write a note on Hydrogen bonding and its consequences.
    (b) How electronic configuration of molecules related to molecular behavior? Explain.
    (c) Explain Fajan's Rule.
35. (a) Discuss the formation and importance of ozone layer.
    (b) What is meant by pollution and pollutants? Explain the classification of air pollutants.
    (c) What are the sources of important air pollutants.

SYLLABUS OF COMPLEMENTARY COURSE Inorganic & Bioinorganic chemistry (Common for Botany/Zoology/Microbiology) (For Students of Microbiology Majors)SEMESTER II Course Code-CH1231 .7 Credit-2

L-T-P 2-0-2 36 hours

Module I –Organometallics (9 hrs)

Definition and classification, Organo metallic compounds of Mg, Sn, Li, Hg, Fe and their synthesis, applications. Biological and environmental aspects of organic compounds – Organometallic compounds in medicines – organomercury, organoboron, organosilicon and organo arsenic compounds – outline of preparation and uses. Antitumour drugs, silylated derivatives of bioactive organic compounds in agriculture and horticulture. Environmental aspects of Organometallic compounds.

ModuleII – Nuclear Chemistry (9hrs)

Natural radioactivity, modes of decay, Geiger –Nuttal rule, artificial transmutation and artificial radioactivity- nuclear stability, n/p ratio, mass defect and binding energy, nuclear fission and nuclear fusion, -applications of radioactivity- ^{14}C dating, rock dating , neutron activation analysis and isotope as tracers

ModuleIII-Coordination Chemistry (9hrs)

Nomenclature, Coordination number and geometry of chelates – isomerism – structural and stereo isomerism - valence bond theory of bonding in octahedral and tetrahedral complexes – drawbacks of valence bond theory – high and low spin complexes – magnetic properties.

Application of coordination complexes in qualitative and quantitative analysis.

Module IV – Bio inorganic compounds (9 hrs)

Metalloporphyrins – cytochromes – chlorophyll photosynthesis and respiration – haemoglobin and myoglobin, mechanism of 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

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

Model Question Paper of BSc Chemistry Programme

2017 Admission onwards

SEMESTER II Complementary CourseMicrobiology majors. Course Code CH1231.7

INORGANIC AND BIOINORGANIC CHEMISTRY

Time: Three Hours Maximum Marks: 80

Section A

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

1. Give the structure of Zeise's salt.
2. Write any one of the preparation methods of organolithium compounds.
3. What is ferrocene? How is it synthesized?
4. What are alpha particles?
5. Define the term radioactivity.
6. Write the IUPAC name of K3[Co(NO2)4Cl2]
7. What are low spin complexes?
8. What do you mean by chelate?
9. What are metalloporphyrins?
10. Give an example of anaerobic respiration.

Section-B

Short answer type (not to exceed one paragraph). Answer any 8 questions from the following. Each question carries two marks

11. What is reformatsky reaction?
12. What is cisplatin? Give its significance.
13. How are organomercurials prepared?
14. Explain Geiger Nuttal Rule.
15. What are half life period and average life period?
16. Define mass defect and binding energy.
17. Write the postulates of Werner's Coordination Theory.
18. What are poly dentate ligands? Give an example.
19. Explain the colours of transition metal complexes.
20. Differentiate respiration and photosynthesis.
21. What are trace elements?
22. What is the role of chlorophil in photosynthesis?

Section-C

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

23. Write a note on organotin compounds.

24.Write a brief note on the applications of organometallic compounds in agriculture and horticulture.
25.One microgram of phosphorus- 32 was injected into a living system for biological tracer studies. The half life period of P-32 is 14.3 days. How long will it take for the radioactivity to fall to 10% of the initial value?
26.Explain the relation between nuclear stability and n/p ratio.
27.Write the biological effects of radiation.
28.Suggest the structure of [NiCl4] on the basis of Valence Bond Theory.
29.Explain the magnetic properties of octahedral complexes with suitable examples.
30.Discuss briefly the biochemistry of iron toxicity and nutrition.
31.Metal ions play a variety of roles in biological systems. Explain.

Section-D

Long essay. Answer any 2 questions from the following. Each question carries fifteen marks.

32.(a) Explain the synthesis and applications or Grignard reagent. (5 marks)
(b) What are Frankland reagents? Give its significance. (5 marks)
(c)Explain about organosilicon compounds in medicine. (5 marks)

33.(a) Explain carbon dating and rock dating. (5 marks)
(b) Give the principle of neutron activation analysis. (5 marks)
(c)Explain the terms nuclear fission and fusion with suitable examples. (5 marks)

34.(a) Write a note on Crystal Field Theory. (5 marks)
(b) Explain the applications of complexes in qualitative analysis. (5 marks)
(c)Write a brief note on isomerism in coordination complexes. (5 marks)

35.(a) Give brief outline of carbon cycle. (5 marks)
(b) Explain nitrogen Fixation. (5 marks)
(c)Write a short note on hemoglobin. (5 marks)

Majors)SEMESTER III Course Code-CH1331 .7 Credit-3T-P 3-0-2
Total - 54 hrs

Module I – Mechanisms in organic substitution reactions (9 hrs)

Electron displacement in organic compounds – Inductive, electromeric and mesomeric effects, influence of inductive effect on acidic and basic properties of organic compounds, hyperconjugation and steric effect.

Reaction mechanism - Bond fission, rate determining step, nucleophilic substitution of Alkylhalides, SN1& SN2 reactions. Effect of structure on reactivity as illustrated by Methyl, ethyl, isopropyl and tertiary butyl groups. Electrophilic addition to ethene and propene – Markownikoff's rule, free radical addition, peroxide effect.

Module II – Stereochemistry (9 hrs)

Optical isomerism, chirality, recemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism due to restricted rotation. Geometrical isomerism, E and Z nomenclature. Aldoximes and ketoximes.

Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, propane, butane cyclohexane, axial and equatorial bonds.

Module III – Carbohydrates (9 hours)

Classification, configuration, glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose. Preparation and properties of glucose and fructose Pyranoside structures of glucose and fructose, furanoside structure of fructose (structure elucidation not expected). Mutarotation and epimerization. Conversion of glucose into fructose and viceversa.

Module IV – Amino acid and Proteins (9 hrs)

Classification and properties – synthesis of glycine, alanine and tryptophan – polypeptides and proteins, peptide linkage, peptide synthesis, polypeptides, primary,secondary, tertiary and quarternary structure of proteins, test for proteins, Enzymes – Characteristics, catalytic action, theory of enzyme catalysis – Michaelis – Menton theory – Co-enzymes.

Module V : Heterocyclic compounds (9hours)

Heterocyclic systems – 5 membered, 6 membered and condensed systems. Structure of pyrrole, Furan and Thiophene. Electrophilic substitution in pyrrole, Furan and Thiophene. Reactivity and orientation – Structure and properties of pyridine. Electorphilic and nucleophilic substitution reactions in pyridine – Basicity and reduction. Structure of purine and pyramidine bases present in nucleic acids.

Module VI– Nucleic acids and Lipids (9 hrs)

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

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

References:

1 . Principles of Organic Chemistry – M. K. Jain, S. Nagin & Co
2. The Text Book of Organic Chemistry – P.L.Soni

3. The Text Book of Organic Chemistry – Arun Bahl & B.S. Bahl
4. Reaction Mechanism in Organic Chemistry – Mukherjee and Singh – Macmillan
5. Organic Chemistry Vol I and II – I.L. Finar
6. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, A textbook of Organic Chemisty, Vikas Publishing House (Pvt) Ltd., New Delhi.

MODEL QUESTION PAPER

SEMESTER III

Complementary Course for Microbiology Majors

COURSE CODE CH1331.7ORGANIC CHEMISTRY

Time: 3 hours Maximum marks: 80

SECTION A

(Answer allquestions. Each question carries 1 Mark)

1)What is heterolytic bond fission?
2) Explain the term rate determining step.
3) Draw the most stable conformer of methyl cyclohexane.
4) Write the epimer of D-Glucose.
5) What are polysaccharides?
6) What are zwitter ions?
7) Relationship between the base sequence in DNA and the amino acid sequence in protein is known as ……..
8) Write the structure of tryptophan.
9) What are heterocyclics? Give examples.
10) Name the purine bases present in DNA. (10x1=10 marks)

SECTION B

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

11) Explain hyper conjugation with an example.
12) Explain Markownikoff's rule with example.
13) What is asymmetric synthesis? Illustrate.
14) Explain racemisation.
15) How will you convert glucose to fructose?
16) Why pyrrole undergoes electrophilic substitution at 3-position.
17) Explain saponification value.
18) What is zwitter ion?
19) Draw the structure of D-Arabinose, D-Ribose, L-Glyceraldehyde and L-Erythrose.
20) Whar are phospholipids?
21) Name the products of hydrolysis of nucleoproteins.
22) Compare the basicity of pyridine and pyrrole.

(8x2=16 marks)

SECTION C

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

23) What is inductive effect? How it influences the acidity of organic acids?
24) Explain the E & Z notation of geometrical isomers with examples.
25) Explain mutarotation and epimerization.
26) Explain the following denaturation and colour reactions of protein.
27) How pyridine is prepared? Explain it important nucleophilic substitution reactions.
28) What are lipids? Give examples. Enumerate their functions.
29) (i) What is peroxide effect? (ii) Draw the different conformers of n-butane.
30) What are enzymes? Give their general characteristics.
31) What is iodine value? Write its importance.

(6x4=24marks)

SECTION D

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

32) (a) Discuss the mechanism and influence of structure on SN2 reactions.
    (b) Discuss the mechanism of addition of HBr to propene in presence of organic peroxide and in the absence of organic peroxides.
    (c) Assign the R and S configuration of D- & L- Lactic acid.
33) (a) What is resolution? Explain any two methods.
    (b) Write short notes on (i) the configuration of aldoxime and ketoxime and (ii) Optical isomerism due to restricted rotation.
    (c) Discuss the ring structure of glucose.
34) (a) Explain two methods of synthesizing peptides.
    (b) Discuss primary and secondary structure of proteins.
    (c) Discuss the electrophilic substitution in pyrrole.
35) (a) Describe the classification of oils.
    (b) Discuss the structure of DNA.
    (c) How glucose reacts with the following (i) Br_2 water (ii) Phenylhydrazine (iii) CH_3OH and dry Conc.HCl.

(2x15=30 marks)

SYLLABUS OF COMPLEMENTARY COURSE

Physical chemistry-(For Students of Microbiology Majors)

SEMESTER IV Course Code-CH1331 .7 Credit-3

T-P 3-0-2 Total - 54 hrs

Module I. Chemical kinetics & Enzyme catalysis 9 Hrs

Chemical kinetics, rate of reactions, various factors influencing rate, order, molecularity, zero, first, second, third order reactions - derivation of first order kinetics - fractional life time, units of rate constants, influence of temperature on reaction rates, Arrhenius equation, Calculation of Arrhenius parameters

Enzyme Catalysis: Classification of enzymes.General properties of Enzymes. Mechanism of enzyme action- Enzyme substrate interaction, Activation energy, Rate of reaction and Michaelis constant. MichaelisMenton equation.

Module II - Ionic equilibrium 9 hrs

Arrhenius, Lowry- Bronstead and Lewis concept of acids and bases, Kw and pH, pH of strong and weak acids, Ka and Kb, mechanism of buffer action, pH of buffer, Hydrolysis of salt, Degree of hydrolysis and hydrolysis constant.

Module III - colloids 9hrs

Colloidal state: Types of colloids, preparation of colloids-Purification of colloids – ultra filtration and electrodialysis, Kinetic, optical and electrical properties of colloids. Ultra microscope, Electrical double layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation Application of colloids – Cottrell precipitator, purification of water and delta formation

Module IV- Instrumentation Method 9hrs

Ultracentrifuge: Principle and application

Spectroscopic techniques: Principle and applications of UV and Visible spectroscopy – types of electronic transitions, concept of chromophore and auxochrome – red and blue shifts – applications.

NMR spectroscopy – nuclear spin – principle of NMR – chemical shift – spin-spin interation – PMR of simple organic molecules $CHBr_2CH_2Br$, CH_3CH_2Br and CH_3CH_2OH. Principle of MRI .

Chromatographic techniques : Principle and application of TLC and HPLC .

Electropheresis: Principle and application of Zone electrophoresis and capillary electrophoresis.

Module V - Thermodynamics - 9 hrs

Basic concepts – System – surroundings – open, closed and isolated systems – Isothermal – isochoric and isobaric process – work – heat – energy – internal energy – Heat capacity at constant volume (Cv) and at constant pressure (Cp) – relation between Cp and Cv – First law– The second law – Enthalpy-Entropy-and Free energy-Criteria for reversible and irreversible process Gibbs –Helmholtz equation, concepts of spontaneous and non spontaneous processes.

Module VI Dilutie solutions: 9hrs

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

References:

1) Physical Chemistry-Rakshit

2) Principles of Physical Chemistry- Puri,Sharma, Pathania

3) Instrumental methods of Chemical Analysis- B.K.Sharma

4) Essentials Of Physical Chemistry - Arun Bahl & B.S. Bahl

5). Y.R.Sharma, Elementary Organic Spectroscopy, Pearson Education, New Delhi

6) Physical Chemistry- N.M.Kapoor

MODEL QUESTION PAPER SEMESTER IV

Complementary Course for Microbiology Majors

COURSE CODE CH1431.7 PHYSICAL CHEMISTRY

Time: 3 hours Maximum marks: 80

SECTION A

(Answer all questions. Each question carries 1 Mark)

1)What is unit of second order rate constant?

2) Give an example for enzyme catalysed reaction.

3) What are Arrhenius acids and bases?

4) Calculate the pH of a decimolar HCl.

5) What is sol?

6) What are lyophobic colloids?

7) What are chromophores?

8) How many peaks will you get for 1,2-dibromoethane in its H-NMR spectrum?

9) Define the term isobaric process.

10) What is cryoscopic constant? (10x1=10 marks)

SECTION B

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

11) Prove half life of a first order reaction is independent of initial concentration.

12) Differentiate order and molecularity. 13)Explain the term conjugate pair.

14) Explain the terms Ka, Kb and Kw

15)State and explain Hardy-Schule rule?

16) What is CMC?

17) What is chemical shift?

18) State first law of thermodynamics. Write its mathematical form.

19) Explain the different systems in thermodynamics.

20) What is R_f value? Write any two factor influencing R_f value.

21) A 5.13% solution of cane sugar (M=342) is isotonic with 0.9% solution of unknown solute. Calculate the molar mass of the solute 22)Define the term (i) molarity and (ii) molality.

(8x2=16 marks)

SECTION C

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

23) For the decomposition of a compound, k = 2.46 x $10^{-5}s^{-1}$ at 273K and 1.63 x 10^{-3} s^{-1} at 303K. Calculate the energy of activation of the reaction.

24) What is buffer? Give examples. Explain buffer action with an example.

25) Describe any two methods of purifying colloids.

26) Explain red and blue shifts in UV-Vis spectroscopy.

27) Write the principle and application of zone electrophoresis.

28) Derive the relationship between Cp and Cv.

29) Derive an expression for the isothermal reversible expansion work of an ideal gas.

30) What is van't Hoff factor? What is its application?

31) Describe the experimental determination of osmotic pressure.

(6x4=24marks)

SECTION D

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

32) (a) Derive the expression for the rate constant in a first order reaction.
(b) Discuss the different factors influencing the rate of reaction.
(c) (i) Explain the general properties of enzymes.
(ii) Briefly discuss the Michaelis-Menton mechanism of enzyme catalysis.

33) (a) Obtain expression for the hydrolysis constant and degree of hydrolysis for the salt of a strong acid and weak base.
(b) Discuss the kinetic and optical properties of colloids.
(c) Write the important applications of colloids.

34) (a) Explain the principle of NMR spectroscopy
(b) Explain spin-spin interaction taking CHBr2-CH2Br as an example. (c) Explain the principle of HPLC.

35) (a) Free energy change is a measure of spontaneity of reactions. Substantiate the statement.
(b) What are collogative properties? Mention different types of colligative properties. The lowering of freezing point of benzene was 2.33K when 0.412g of a solute of unknown molar was dissolved in 9.31g of benzene. Calculate the molar mass of the solute. Molal depression constant of benzene is 5.1K/m. (c) Explain the following (i) Reverse osmosis (ii) Applications of UV-Vis spectroscopy.

(2x15=30 marks)

SYLLABUS FOR LABORATORY COURSES FOR COMPLEMENTARY CHEMISTRY Course V
Course Code CH1432 .7 Credit 2 Semesters 1,2,3 & 4For students of Botany, Zoology, Home Science, Biochemistry and Microbiology majors.

Qualitative Analysis

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

Organic preparations

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

A student has to analyse at least twelve organic compounds.

Volumetric Analysis

A.Acidimetry and alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard
b. Estimation of a strong base and a weak base using standardized HCl)

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

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

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

e. Estimation of a strong acid using standardized NaOH

B. Permanganometry

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

c. Estimation of Mohr's salt d. Estimation of calcium

C. Dichrometry

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

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

D. Iodimetry and Iodometry

a. Standardisation of sodium thiosulphate using std potassium dichromate b. Estimation of copper in a solution

c. Estimation of iodine

E. Complexometric titrations

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

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

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

Chromatography

a.Paper chromatographic separation of mixture of nitroanilines, amino acids and sugars

b.Separation of a mixture of dyes by column chromatography.

Gravimetric Analysis

1. Estimation of water of hydration in barium chloride crystals

2. Estimation of barium in barium chloride solution.

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

The scheme of practical examination may be framed by the Board of Examiners.