

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Proposed Scheme of Integrated B.Sc. (Hons/Hons. with Research)-M.Sc.
Chemistry/Physics/Mathematics programme under National Education Policy 2020
(w.e.f. 2023-24)

SEMESTER-I

Course Code	Course	Nomenclature	Credits	Hrs/week	Marks		
					Ext.	Int.	Total
23CHL101	Discipline Specific Course (DSC-A1)	Chemistry-I	4	4	70	30	100
23PHL101	Discipline Specific Course (DSC-B1)	Physics-I (Mechanics)	4	4	70	30	100
23MAL101 / 23BIL101	Discipline Specific Course (DSC-C1)	Mathematics-I (Algebra) OR Biology-I	4	4	70	30	100
23PHP101	Minor Course (MIC1)	Physics Lab-I	2	4	35	15	50
23MAL102 / 23BIL102	Multidisciplinary Course (MDC1)	Elementary Mathematics-I OR Elementary Biology-I	3	3	50	25	75
23ENG101	Ability Enhancement Course (AEC1)	English	2	2	35	15	50
23MAL103 / 23CHL102 / 23PHL102 / 23BIL103	Skill Enhancement Course (SEC1)	Basic Statistics OR Role of Chemistry in Society OR Physics of sustainable development OR Life style disorder	3	3	50	25	75
23EVL101	Value Added Course (VAC1)	Environmental Science	2	2	35	15	50
			24	26	415	185	600

SEMESTER-II

Paper code	Course	Nomenclature	Credits	Hrs/week	Marks		
					Ext.	Int.	Total
23CHL201	Discipline Specific Course (DSC-A1)	Chemistry-II	4	4	70	30	70
23PHL201	Discipline Specific Course (DSC-B1)	Physics-II	4	4	70	30	70
23MAL201 / 23BIL201	Discipline Specific Course (DSC-C1)	Mathematics-II (Calculus) OR Biology-II	4	4	70	30	100
23CHP201	Minor Course (MIC1)	Chemistry Lab-II	2	4	35	15	50
23MAL202 / 23BIL202	Multidisciplinary Course (MDC1)	Elementary Mathematics-II OR Elementary Biology-II	3	3	50	25	75
23HIL201	Ability Enhancement Course (AEC1)	Hindi	2	2	35	15	50
23CSL201 / 23BIL202	Skill Enhancement Course (SEC1)	Fundamentals of Computers Or Biofertilizer	3	3	50	25	75
23PTL201	Value Added Course (VAC1)	Yoga and Meditation	2	2	35	15	50
			24	26	415	185	600

Notes:

- i) Students who have studied mathematics at 10+1 and 10+2 level shall opt Elementary Biology-I & II and those who have studied Biology shall opt Elementary Mathematics-I&II in 1st and 2nd semesters.
- ii) Semester-I & II will be common for all the three Integrated B.Sc. (Hons/Hons with research)-M.Sc. Chemistry/Physics/Mathematics programmes.
- iii) The student opting for exit after first year must complete summer internship of 4 credits (120 hrs.) to get UG Certificate.

DEPARTMENT OF CHEMISTRY
GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR

Integrated B.Sc. (Hons/Hons. with research)-M.Sc. (Chemistry/Physics/Mathematics)
Integrated B.Sc. (Life Science)-M.Sc. (Biotechnology/Microbiology/Botany/Zoology)

CHEMISTRY-I

Paper code: 23CHL101

60 Hrs (4Hrs / week)

Credits:4

Time: 4 Hrs

Marks for Major Test (External): 70

Marks for Internal Exam:30

Total Marks: 100

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Chemical Thermodynamics

15 Hrs

Objectives and limitations of Chemical Thermodynamics, state functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy. First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion. Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle). Entropy: Entropy changes of an ideal gas with changes in P, V, and T. Free energy and work functions. Gibbs-Helmholtz Equation, Criteria of spontaneity in terms of changes in free energy. Introduction to Third law of thermodynamics.

UNIT-II

Conductance and Electrochemistry

15 Hrs

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance to measure degree of dissociation of weak electrolytes.

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half cell potentials, application of electrolysis in metallurgy and industry. Chemical cells with examples; Standard electrode (reduction) potential.

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UNIT-III

15 Hrs

Fundamentals of Organic Chemistry

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles.

Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

UNIT-IV

Stereochemistry

8Hrs

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis-trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Chemistry of Biomolecules

7Hrs

Occurrence, classification of Carbohydrates. Amino acids, peptides and their classification. α -Amino Acids. Zwitterions, pK values, isoelectric point, components of nucleic acids, nucleosides and nucleotides.

BOOKS SUGGESTED:

1. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
2. Castellan, G.W., Physical Chemistry, Narosa Publishers
3. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
7. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
8. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

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Integrated B.Sc. (Life Science)-M.Sc. (Biotechnology/Microbiology/Botany/Zoology)
CHEMISTRY-II

Paper code: 23CHL201

60 Hrs (4Hrs / week)

Credits: 4

Time: 4 Hrs

Marks for Major Test (External): 70

Marks for Internal Exam: 30

Total Marks: 100

Note: The examiner is requested to set nine questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each UNIT and the compulsory Question No.1.

UNIT-I

Chemical Bonding and Molecular Structure

15 Hrs

Introduction to Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, polarizing power and polarizability

Introduction to Covalent bonding: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Ionic Solids: Factors affecting the formation of ionic solids, concept of close packing, radius ratio rule and coordination number. Calculation of limiting radius ratio for tetrahedral and octahedral sites. Structures of some common ionic solids: NaCl, ZnS (zinc blende and wurtzite).

UNIT-II

Acids and Bases

8 Hrs

Brönsted-Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Basic Coordination Chemistry

7Hrs

Coordinate Bond. Werner's coordination theory, ligands, chelates. Nomenclature of coordination compounds. Stereochemistry of different coordination numbers, isomerism. Valence-bond and crystalfield theories of bonding in complexes. Explanation of properties such as geometry colour and magnetism.

UNIT-III

Chemical Kinetics and Catalysis

15 Hrs

Rates of reactions, rate constant, order and molecularity of reactions. Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy.

Catalysis: Homogeneous catalysis, Acid-base catalysis and enzyme catalysis. Heterogeneous catalysis.

UNIT-IV

15Hrs

Basics of spectroscopy

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. Electromagnetic radiations, Introduction to ultraviolet, visible and infrared spectroscopy, electronic transitions, λ_{max} & ϵ_{max} , chromophore, auxochrome, bathochromic, hypsochromic shifts. Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

BOOKS SUGGESTED:

1. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.
2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS, 1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry: Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.
5. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley, 1987.
6. Puri B.R., Sharma L. R. and Pathania M. S., Principles of Physical Chemistry, Pubs: Vishal Publishing Company, 2003.
7. Laidler K. J Chemical Kinetics, McGraw Hill.
8. Castellan G.W. Physical Chemistry, Narosa Publishers
9. Kemp W. Organic Spectroscopy

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Integrated B.Sc. (Life Science)-M.Sc. (Biotechnology/Microbiology/Botany/Zoology)

CHEMISTRY LAB-II

Paper code: 23CHP201

60 Hrs (4Hrs / week)

Credits: 2

Time: 4 Hrs

Marks for Major Test (External): 35

Marks for Internal Exam: 15

Total Marks: 50

1. Redox titrations: Determination of Fe^{2+} , $\text{C}_2\text{O}_4^{2-}$ (using KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)
2. Iodometric titrations: Determination of Cu^{2+} (using standard hypo solution).
3. Complexometric titrations: Determination of Mg^{2+} , Zn^{2+} by EDTA.
4. Paper Chromatography: Qualitative Analysis of any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+} , Cu^{2+} , Ca^{2+} , Ni^{2+} , Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).
5. To determine the surface tension of at least two liquids using stalagmometer by drop no. and drop weight methods (Use of organic solvents excluded).
6. To determine the viscosity of at least two liquids by using Ostwald's viscometer (use of organic solvents excluded).
7. To determine the specific refractivity of at least two liquids.
8. Determine rate constant of acid catalyzed hydrolysis of methyl acetate.
9. To study the process of (i) sublimation (ii) Crystallization of camphor and phthalic acid
10. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
 - (i) Iodoform from ethanol (or acetone)
 - (ii) p-Bromoacetanilide from acetanilide
11. The preliminary examination of physical and chemical characteristics (physical state, colour, odour and ignition test), extra element detection (N, S, Cl, Br and I).

BOOKS SUGGESTED:

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G., Vogel's Text Book of Practical Organic Chemistry, 5th Edn., Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole, 2005.
3. Mann F.G., Saunders P.C., Practical Organic Chemistry, Pubs: Green & Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.
6. Yadav J. B., Advanced Practical physical Chemistry.

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Integrated B.Sc. (Hons/Hons. with Research)-M.Sc. Semester - I

Skill Enhancement Course (SEC1)

Course code: 23CHL-102

Nomenclature: Role of Chemistry in Society

45 Hrs (3Hrs /week)

Credits: 3

Time: 3 Hrs

Marks for Major Test (External): 50

Marks for Internal Exam: 25

Total Marks: 75

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist of five short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

UNIT-I

11 Hr

Analysis of soil: Composition of soil, Concept of pH and pH measurement of soil, Complexometric titrations, Chelation, Chelating agents, use of indicators. Estimation of Calcium and Magnesium ions in soil.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity, alkalinity and dissolved oxygen of a water sample.

UNIT-II

11 Hr

A general study including preparation and uses of the following: Hair dye, soap, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

UNIT-III

11 Hr

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, brief introduction of structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (Dieldrin); Organophosphates (Malathion); Quinones (Chloranil), Anilides (Alachlor)

UNIT-IV

12 Hr

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

Books:-

1. Willard, H. H. Instrumental Methods of Analysis, CBS Publishers, 1988.
2. Skoog, D.A. and Leary, J.J., Instrumental Methods of Analysis, Saunders College Publications, New York, 1992
3. Skoog, D.A.; West, D.M. and Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort Worth, 1992
4. Harris, D. C. Quantitative Chemical Analysis 7th Ed., W. H. Freeman and Co., New York, 2007
5. Dean, J. A. Analytical Chemistry Handbook, McGraw Hill, 2007

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6. Day, R. A. and Underwood, A. L. Quantitative Analysis, Prentice Hall of India, 1991
7. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
8. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
9. B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut.
10. R. Cremllyn: Pesticides, John Wiley.
11. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
12. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
13. B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut.

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