List of Revised Courses

Department : Chemistry

Programme Name : B.Sc.

Academic Year : 2024-25

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	CYUAMJT2	Basic Concepts of Chemistry-II

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2024-25

School : *School of Studies of Physical Science*

Department : *Chemistry*

Date and Time : *Jan. 19, 2025 – 4:00 pm*

Venue : *Meeting room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Chemistry, School of Studies of Physical Science, Guru Ghasidas Vishwavidyalaya, Bilaspur was held to design and discuss the structure and scheme of examination of Integrated UG/PG, M. Sc. Chemistry syllabi.

The following members were present in the meeting:

Prof. Samar Das – External Subject Expert

Mrs. Pushpa Ambrose- External expert from Industry

Prof. G.K. Patra – Chairman

Prof. Charu Arora – Member

Prof. Asish Kumar Singh- Member

Prof. Khemchand Dewangan- Member

Prof. Manorama- Member

Dr. S. K. Singh – Invitee

Dr. S.S. Thakur- Member

Dr. Arti Shrivastava- Invitee

Dr. S. Banerjee – Invitee

Dr. Bhaskar Sharma- Invitee

Dr. Suryabhan Singh-Member

Dr. Bharatlal Sahu- Invitee

Dr.U.P. Azad- Invitee

Dr. Niraj Kumari-Invitee

Dr. Bijanneswar Mondal-Invitee

Following points were discussed during the meeting

Resolution of Agenda Item (a)

At the outset of the meeting drafts of revised course structure and syllabus of B.Sc. II Semester and draft of course structure and syllabus

अध्यक्ष/Head
रसायन शास्त्र विभाग
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Guru Ghasidas Vishwavidyalaya,
बिलासपुर 495009 (छ.ग.)
Bilaspur 495009 (C.G.)

of B.Sc. IV Semester of 4-Year UG Program as per NEP 2020 prepared by the faculty members of the Department were presented.

The course content of the Major Paper of B.Sc. II Sem, 'Basic Concepts of Chemistry II) has been revised. After thorough discussion the course structures and the course contents of B.Sc. II and IV Semesters were approved with the incorporation of the suggestions of the honourable external members of the BoS.

Resolution of Agenda Item (b):

According to the University's NEP Ordinance, a four-credits vocal course must be added to the B.Sc. II and B.Sc. IV semester curricula independently. To this endevour the drafts of two VOC Papers titles of which are (i) Green Water Technology and (ii) Cement Chemistry have been put forward in the meeting. The course contents were also thoroughly discussed. After comprehensive discussion the course contents of (i) Green Water Technology and (ii) Cement Chemistry were approved with the addition of some topic as suggested by the external experts. It was resolved that the VOC Paper Green Water Technology is suitable for B.Sc. II Semester and Cement Chemistry is suitable for B.Sc. IV Semester.

Resolution of Agenda Item (c):

MOOCs coordinator of the Department submitted the following details of the ongoing SWAYAM courses to be offered as MOOCs courses for UG PG Programmes.

Course Name	Faculty & Institute	Course type & Credits	Registration details
For B.Sc. Sem-IV Students			
Advanced Transition Metal Organometallic Chemistry	Prof. P. Ghosh IIT Bombay	Core 3 credits 12 weeks	Start Date : 20 Jan 2025 End Date : 11 Apr 2025 Enrollment Ends : 27 Jan 2025 Exam Registration Ends : 14 Feb 2025 Exam Date : 27 Apr 2025
Elementary Electrochemistry	Prof. Angshuman Roy Choudhury IISER Mohali	Core 2 credits 8 weeks	Start Date : 20 Jan 2025 End Date : 14 Mar 2025 Enrollment Ends : 27 Jan 2025 Exam Registration Ends : 14 Feb 2025 Exam Date : 22 Mar 2025
For M.Sc. Sem-II Students			
Chemistry Of Main Group Elements	Prof. M. S. Balakrishna IIT Bombay	Core 3 credits 12 weeks	Start Date : 20 Jan 2025 End Date : 11 Apr 2025 Enrollment Ends : 27 Jan 2025 Exam Registration Ends : 14 Feb 2025 Exam Date : 27 Apr 2025
Pericyclic Reactions and Organic Photochemistry	Prof. S. Sankararaman IIT Madras	Core 2 credits 8 weeks	Start Date : 20 Jan 2025 End Date : 14 Mar 2025 Enrollment Ends : 27 Jan 2025 Exam Registration Ends : 14 Feb 2025 Exam Date : 22 Mar 2025

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The members of BoS after discussion unanimously approved the MOOCs Courses (i) Advanced Transition Metal Organometallic Chemistry (3 credits) and (ii) Elementary Electrochemistry (2 credits) for B.Sc. IV Semester & (iii) Chemistry of Main Group Elements and (iv) Pericyclic Reactions and Organic Photochemistry for M.Sc. II Semester. This MoM is to be submitted to the competent authority for kind approval. The meeting ended with vote of thanks from the chair.

अध्यक्ष/Head
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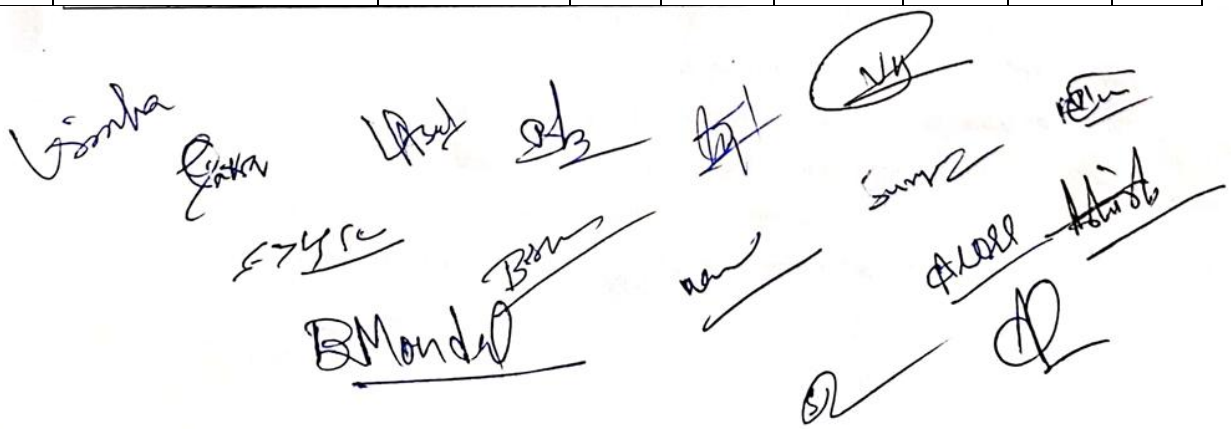
Signature & Seal

Scheme and Syllabus

Sem.	Courses	Course Code	Number of courses	Level	Credits	Credits (L+T+P)	Int. Marks	Ext. Marks	Total
II	Major-I		Basic Concepts in Chemistry-II (Theory)	2	3	(3+0+0)	30	70	100
			Basic Concepts in Chemistry-II (Lab)		1	(0+0+1)	30	70	100
	Minor-I		Opted from the Pool Course offered by University	2	4		30	70	100
	Multidisciplinary		Opted from the Pool Course offered by the University	1	3		30	70	100
	AEC		Opted from the Pool Course offered by University	1	2		30	70	100
	SEC		Opted from the Pool Course offered by University	1	3		30	70	100
	VAC-1		Opted from the Pool Course offered by University	1	2		30	70	100
	VAC-2		Opted from the Pool Course offered by University	1	2		30	70	100
			Total		**20**				**800**



Semester-II (Theory), Core 1 Level 2, Credit 3

Physical Chemistry

Unit – I: Thermodynamics – I

Introduction of different terms and processes in thermodynamics: State and path functions and their mathematical differentials treatment, partial derivatives, Euler's reciprocity, and cyclic rule.

First Law: Concept of heat, *q*, work, *w*, internal energy, *U*, and sign convention for heat and work; Statement of first law; Enthalpy, *H*; heat capacities (C_v and C_p) and their relationships. Reversible and irreversible processes, maximum work. Calculations of *q*, *w*, *U*, and *H* for reversible, irreversible, and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Ideal gas law for adiabatic reversible expansion; comparison of adiabatic and isothermal reversible expansion. Joule-Thomson effect. Standard state and Thermochemistry (Hess's Laws and Kirchhoff's equation).

(10 Hours)

Unit – II: Chemical and Phase Equilibria

Law of mass action; K_p, K_c, and K_x; Effect of temperature on K; Le-Chatelier principle; Ionic equilibria in solutions; pH and buffer solutions; Derivation of Henderson-Hasselbalch equation, buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry, Salt hydrolysis, hydrolysis constant, degree of hydrolysis and pH for different salts; Solubility and solubility product; Acid – base titration curves; Theory of acid–base indicators; selection of indicators and their limitations.

Concept of phases, components and degrees of freedom; Gibbs Phase Rule; Phase diagrams with applications for one-component systems (water and sulfur) and two component systems involving eutectics, congruent, incongruent melting points and solid solution (lead-silver, $FeCl_3$-H_2O and Na-K *etc*.).

(15 Hours)

Reference Books:

- P. Atkins, J. d. Paula and K. James, *Physical Chemistry*, 11th Ed., Oxford University Press, **2018**.
- T. Engel and P. Reid, *Physical Chemistry*, 3rd Ed., Pearson, **2014**.
- S. Glasstone, *Thermodynamics for Chemists*, Affiliated East-West Press P. Ltd, **2003**.
- K. L. Kapoor, *A Text Book of Physical Chemistry: Thermodynamics and Chemical Equilibrium, Vol. 2*, 5th Ed., MsGraw-Hill, **2015**.
- K. J. Laidler and J. H. Meiser, *Physical Chemistry*, 2nd Ed., CBS Publishers, **2006**.
- B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., **2018**.
- R. P. Rastogi and R. R. Mishra, *An Introduction to Chemical Thermodynamics*, 6th Ed., Viksh Publishing House, **2018**.
- S. Alberty, *Physical Chemistry*, 3rd Ed., John Wiley & Sons, Inc., **2003**.
- D. R. Crow, *Principles and Applications of Electrochemistry*, 4th Ed., Blackie Academic & Professional, **1994**.

Organic Chemistry

UNIT I: Chemistry of aliphatic hydrocarbons

***Alkanes and cycloalkanes*:** Preparation and general reactions of alkanes and cycloalkanes, Bayer Strain theory of strainless ring; Conformation of ethane, *n*-butane and cyclohexane, chlorination of methane and side chain chlorination of toluene.

***Alkenes*:** General methods for preparation of alkenes, Reactions of alkenes: Addition reactions (Electrophilic and free radical), Halogenation, Hydrohalogenation, Hydration, Hydroxylation, Hydroboration-oxidation, Mercuration-demercuration, Epoxidation and Ozonoloysis.

***Dienes*:** Conjugated and isolated Dienes; 1,2- versus 1,4-addition. Diels-Alder reaction of dienes: Mechanism

***Alkynes*:** Preparation of alkynes, acidity and metal acetylides, Electrophilic addition reactions viz., Halogenation, Hydrohalogenation, Hydration, Hydroboration-oxidation, Mercuration-demercuration and Ozonoloysis.

(16 Hours)

UNIT II: Stereochemistry:

Optical activity and plane-polarized light. Plane and centre of Symmetry, Chirality, enantiomers, diasteroisomers, mesomers, and racemic mixtures. Fischer, Newman and Sawhorse Projection Formula. E/Z, D/L and R/S nomenclature. Walden inversion. Stereochemistry of allenes and biphenyls.

(10 Hours)

Recommended Books/References:

- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
- J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford University Press.
- P Sykes, *A Guide Book to Mechanism in Organic Chemistry*, 6th Edition (1997), Orient Longman, New Delhi.
- *"Organic Chemistry",* S. M. Mukherjee, S. P. Singh, and R. P. Kapoor, 1st Edition (1985), New Age International (P) Ltd. Publishers, New Delhi.
- *"Organic Chemistry",* I. L. Finar**,** [Vol. I, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in1996], ELBS and Longman Ltd., New Delhi.
- *"Organic Chemistry – Structure and Reactivity",* Seyhan N. Ege, 3rd Edition (1998), AITBS Publishers and Distributors, Delhi.
- *"Organic Chemistry",* Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
- "*Organic Chemistry"*, G. Solomon, Willey India, Paper Back, 9th Edition.
- "*Modern Organic Chemistry"*, M. K. Jain and S. C. Sharma**,** Vishal Publishing CO. Jalandhar, India, 4th Edition (2012).
- "*Stereochemistry of Organic Compounds"*, D. Nasipuri, New Age International.
- "*Stereochemistry of Organic Compounds"*, P.S. Kalsi, New Age International.

Inorganic Chemistry

UNIT-I: Chemistry of s, p and d Block Elements **12 Lectures**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and Catenation, Complex formation tendency of s and p block elements. Classification of Metal-Hydrides. Structure, Bonding, and Uses: Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of Nitrogen, Phosphorus Sulphur and Chlorine. Occurrence and uses, rationalization of inertness of noble gases, Bonding in noble gas compounds (Valence bond and MO treatment for XeF_2).

d block elements: General electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. Stability of various oxidation states. Difference between the first, second and third row transition elements.

UNIT-II: Bioinorganic Chemistry **8 Lectures**

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on distribution of metals. Sodium/K-pump, Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), Iron and its application in biosystems, Haemoglobin.

Recommended books/references:

1 Lee, J.D. Concise Inorganic Chemistry, ELBS,1991.
2 Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y.1994.
3 Greenwood, N.N., Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997.
4 Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH,1999.
5 Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
6 Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry Fourth Ed., Pearson, 2010
7 Atkins, P. W and Shriver D. N. Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

Semester-II (Practical)

Physical Chemistry

1. Thermochemistry:

(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat

Revised syllabus

Semester	Nature of Course	Course Code	Name of the course	Credits
II	Major (Level 2)	CYUBMJT1	Basic Concepts in Chemistry-II	Theory 3 (45 Lectures)
		CYUBMJL1	Basic Concepts in Chemistry-II (Lab)	Practical: 1 (30 Hours)

CYUBMJT1: Basic Concepts in Chemistry-II

Level 2, Credit 3 (45 Lectures)

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand the first law of thermodynamics and its applications.
2. Know the chemical equilibrium, pH of solution, buffer solution and application.
3. Understand aliphatic hydrocarbons alkanes, alkenes, alkynes.
4. Understand reaction intermediates and their characteristics.
5. Know the chemistry of s, p, and d block elements.
6. Understand the role of metals in biological systems.

Physical Chemistry

Unit – I: First Law of Thermodynamics

Introduction of different terms and processes in thermodynamics: State and path functions and their mathematical differentials treatment, partial derivatives, Euler's reciprocity, and cyclic rule.

First Law: Concept of heat, q, work, w, internal energy, U, and sign convention for heat and work; Statement of first law; Enthalpy, H; heat capacities (C_v and C_p) and their relationships. Reversible and irreversible processes, maximum work. Calculations of q, w, U, and H for reversible, irreversible, and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Ideal gas law for adiabatic reversible expansion; comparison of adiabatic and isothermal reversible expansion. Joule-Thomson effect. Standard state and Thermochemistry (Hess's Laws and Kirchhoff's equation).

(8 Lectures)

Unit – II: Chemical Equilibrium

Law of mass action; K_p, K_c, and K_x; Effect of temperature on K; Le-Chatelier principle; Ionic equilibria in solutions; pH and buffer solutions; Derivation of Henderson-Hasselbalch equation, buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry, Salt hydrolysis, hydrolysis constant, degree of hydrolysis and pH for different salts; Solubility and solubility product; Acid-base titration curves; Theory of acid-base indicators; selection of indicators and their limitations.

(7 Lectures)

Organic Chemistry

Unit – I: Chemistry of Aliphatic Hydrocarbons

***Alkanes and cycloalkanes*:** Preparation and general reactions of alkanes and cycloalkanes, Bayer Strain theory of strainless ring; Conformation of ethane, *n*-butane and cyclohexane, chlorination of methane and side chain chlorination of toluene.

***Alkenes*:** General methods for preparation of alkenes, Reactions of alkenes: Addition reactions (Electrophilic and free radical), Halogenation, Hydrohalogenation, Hydration, Hydroxylation, Hydroboration-oxidation, Mercuration-demercuration, Epoxidation and Ozonoloysis.

***Dienes*:** Conjugated and isolated Dienes; 1,2- versus 1,4-addition. Diels-Alder reaction of dienes: Mechanism

***Alkynes*:** Preparation of alkynes, acidity and metal acetylides, Electrophilic addition reactions viz., Halogenation, Hydrohalogenation, Hydration, Hydroboration-oxidation, Mercuration-demercuration and Ozonoloysis.

(9 Lectures)

Unit – II: Stereochemistry:

Optical activity and plane-polarized light. Plane and centre of Symmetry, Chirality, enantiomers, diasteroisomers, mesomers, and racemic mixtures. Fischer, Newman and Sawhorse Projection Formula. E/Z, D/L and R/S nomenclature. Walden inversion. Stereochemistry of allenes and biphenyls.

(6 Lectures)

Inorganic Chemistry

Unit – I: Chemistry of s, p, and d Block Elements

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and Catenation, Complex formation tendency of s and p block elements. Classification of Metal-Hydrides. Structure, Bonding, and Uses: Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of Nitrogen, Phosphorus Sulphur and Chlorine. Occurrence and uses, rationalization of inertness of noble gases, Bonding in noble gas compounds (Valence bond and MO treatment for XeF_2).

d-block elements: General electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. Stability of various oxidation states. Difference between the first, second and third-row transition elements.

(10 Lectures)

Unit – II: Bioinorganic Chemistry

Metal ions present in biological systems, classification of elements according to their action in biological systems. Geochemical effect on distribution of metals. Sodium/K-pump, Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd, and As), iron and its application in biosystems, Haemoglobin.

(5 Lectures)

Recommended Books/References:

- P. Atkins, J. d. Paula and K. James, *Physical Chemistry*, 11th Ed., Oxford University Press, **2018**.
- B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., **2018**.
- D. R. Crow, *Principles and Applications of Electrochemistry*, 4th Ed., Blackie Academic & Professional, **1994.**
- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
- P Sykes, *A Guide Book to Mechanism in Organic Chemistry*, 6th Edition (1997), Orient Longman, New Delhi.
- "*Stereochemistry of Organic Compounds"*, D. Nasipuri, New Age International.
- "*Stereochemistry of Organic Compounds"*, P.S. Kalsi, New Age International.
- Lee, J.D. Concise Inorganic Chemistry, ELBS,1991.
- Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH,1999.
- Rodger, G.E. Inorganic and Solid-State Chemistry, Cengage Learning India Edition, 2002.
- Atkins, P. W and Shriver D. N. Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

CYUBMJL1: Basic Concepts in Chemistry-II (Lab)

Credit 1 (30 Hours)

Physical Chemistry

1. Thermochemistry:

(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).

(b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

(c) Calculation of the enthalpy of ionization of ethanoic acid.

(d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.

(e) Determination of enthalpy of hydration of copper sulfate.

(f) Study of the solubility of benzoic acid in water and determination of ΔH.

2. pH metry

(a) Determination of pH of the given unknown solutions.

(b) Study the effect on pH of the addition of HCl/NaOH to solutions of acetic acid, sodium acetate, and their mixtures.